New Jersey. Coastal Zone Management Program

Resource Recovery

Environmental Assessment Guidebook and Site Analysis

Prepared for
East Brunswick Township
New Jersey

Prepared by
Rogers, Golden & Halpern

RESOURCE RECOVERY
ENVIRONMENTAL ASSESSMENT GUIDEBOOK
AND SITE ANALYSIS

Prepared for
East Brunswick Township
New Jersey

Prepared by
ROGERS, GOLDEN & HALPERN
in association with
Quantum Associates,
A Division of Beaumont Environmental, Inc.
and Greeley and Hansen

December 1981

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FOREWORD

To help fulfill its responsibility to review and assess the environmental impacts of the proposed Edgeboro Resource Recovery Facility (RRF), the Township of East Brunswick applied for a Coastal Energy Impact Program Grant from the New Jersey Department of Energy. Rogers, Golden & Halpern was engaged to conduct a site analysis and develop a guidebook on environmental assessment for other RRFs that may be constructed in the state. The guidebook emphasizes environmental issues. A municipality, however, must balance environmental concerns with social and economic ones. The guidebook approach is not intended to act as an impediment to resource recovery projects; on the contrary, it is meant to help resource recovery projects develop an efficient planning process that identifies the concerns of the municipalities in the beginning so that a responsive and environmentally safe project can be developed.

The prime objective of the guidebook is to present usable methods for identifying, measuring, and evaluating the effects of RRFs and associated activities such as transfer stations and transport systems.

The guidebook is a reference for participants in the review and approval of resource recovery and solid waste facility projects, as well as for those charged with planning. It was developed with New Jersey's municipal and county officials in mind, but it will also prove useful to private facility developers, state officials, and others who have an interest in the biophysical and sociocultural environment.

The need for this sort of guidebook stems from the fact that the state has certain regulations and permits that an RRF developer, whether public or private, will have to abide by; however, the state, by the nature of its authority, does not control all aspects of a major development in New Jersey. Impacts related to traffic, noise, commerce, and the like lie within the concern and power of the municipalities. The guidebook is intended to enable municipal officials to review their ordinances and make themselves familiar with the facility and related impacts. If the planning and regulatory framework is not in place before the filing of an application to build, the municipality will not be able to make responsible decisions about these facilities within the time constraints dictated by New Jersey's Municipal Land Use Law.

No guidebook that deals with dynamic political concerns and complex techniques can stand as the sole source of information. Users of this volume are encouraged to consult the references and public agencies cited to obtain more information and assistance.

ACKNOWLEDGMENT

This study was greatly aided by the information and insights generously made available to us by professionals working in and around the project area and in Municipal, County, State and Federal Agencies.

Mr. Carl Hintz and Mr. William Tanner provided support and directions throughout the study. As part of the transfer station site selection process, Mr. Carl Hintz directed the on-site review and analysis of candidate sites. The Steering Committee provided guidance and focus to the project.

We especially acknowledge the following individuals for their help in formulating the study, compiling data and reviewing draft materials:

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Mr. Norbert Psuty*	Center for the Coastal Environment
Ms. Debbie Rainwater*	East Brunswick Township
Ms. Mary T. Sheil	NJ DOE/DEP Office of Recycling
Ms. Marilyn Stamberg	East Brunswick Township
Mr. G. Tyler*	NJ DEP Solid Waste Administration
Mr. Raymond Worob	NJ DEP Solid Waste Administartion

*Steering Committee members

PROJECT STAFF

Rogers, Golden & Halpern

Principal-in-charge	John Rogers
Project Manager	Alan Kurtz
Senior Environmental Planner	Jeff Deis
Transportation Economist	Robert Pierson
Legislative and Policy Analyst	Barbara Cushmore Pretz
Graphics	Sue Deis Gene Gilroy Sasi Judd Joan S. McCusker Sam Karen Norgard Kim Tomlinson Annette Van de Bunt Mark Yankoski
Editing	Jane Barry Sandy Dechert Sue McGuire
Word Processing	Grace Bader Norman Hall Valerie Smith

Quantam Associates, a Division of Beaumont Environmental Incorporated

Klaus Feindler

Greeley and Hansen

John Spitko

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CHAPTER 1. INTRODUCTION

BACKGROUND

Wheelabrator-Frye, Incorporated, has proposed to construct and operate a Resource Recovery Facility (RRF) adjacent to the existing Edgeboro landfill located within the Township of East Brunswick, New Jersey. The RRF will be designed to process up to a maximum of 1,340 tons of municipal solid waste per day. According to Wheelabrator-Frye, refuse will be received 12 hours per day, six days per week, by packer trucks and transfer trailers. The RRF will also be capable of receiving solid waste via barges. Storage at the facility will be provided for approximately one and one-half days' consumption of solid waste in order to ensure the plant's continuous operation and acceptance of refuse. Over 200 million kilowatt hours of electricity will be generated annually at the RRF and transmitted to Public Service Electric and Gas.

The on-site and transportation (off-site) components of this facility have the potential for significant impacts in East Brunswick since the approved solid waste management plan for the county projects increasing solid waste delivery to the Edgeboro landfill through 1990 in addition to the solid waste to be processed at the proposed RRF. The plant is scheduled to begin operations in 1985, assuming commencement of construction at the beginning of 1982.

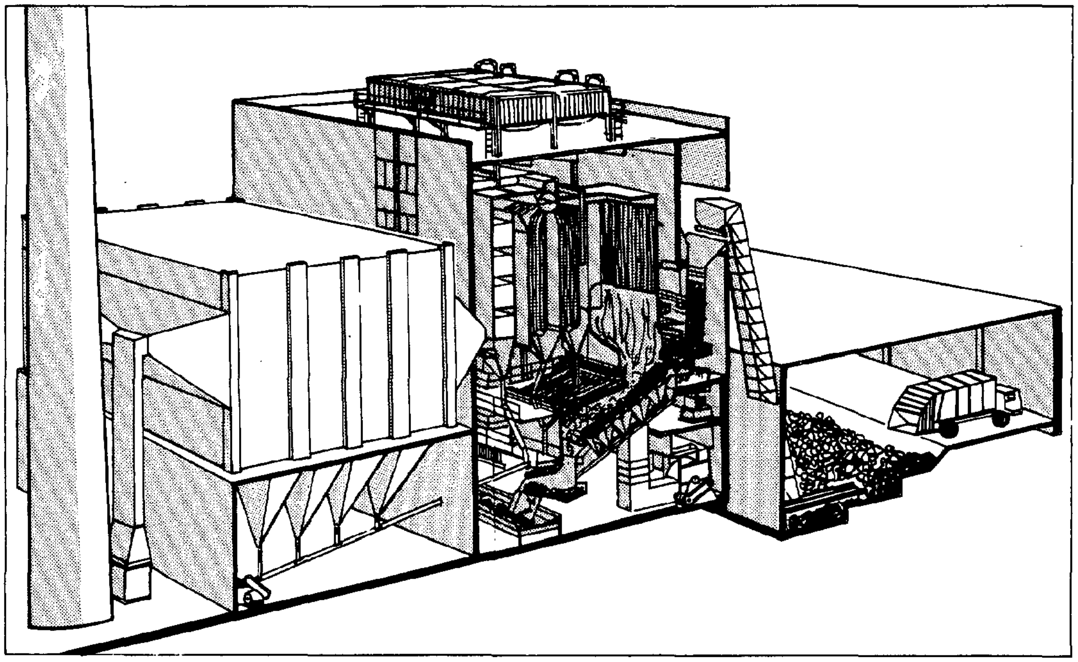
Figure 1 is an illustration of a typical resource recovery facility, showing the reception area and waterwall incinerator. Figure 2 is a site plan of a typical RRF, and figure 3 is an elevation diagram.

SETTING

The proposed Edgeboro RRF is to be situated adjacent to approximately 200 acres of existing, permitted landfill in the Township of East Brunswick, Middlesex County, New Jersey. Figure 4 shows the regional setting of the proposed facility. Figure 5 focuses on the project's location.

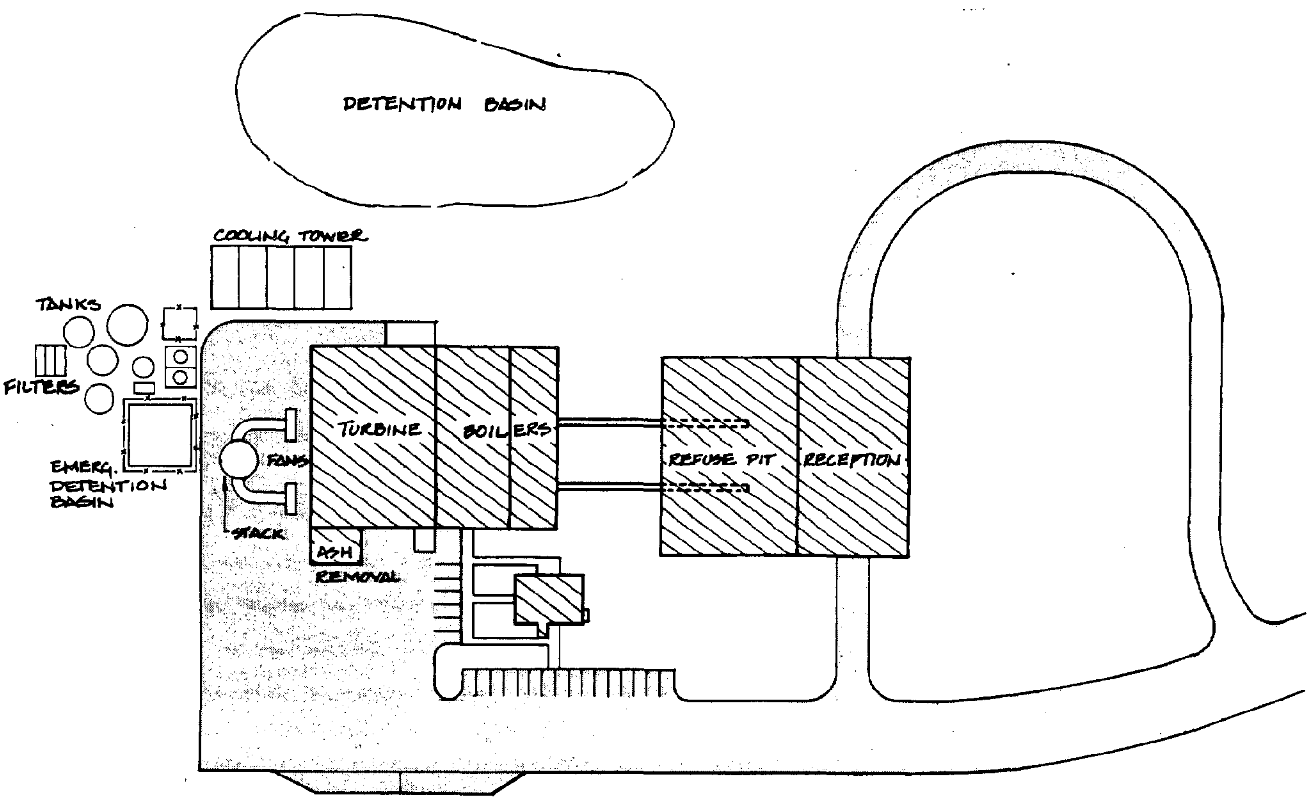
The site for the proposed facility is buffered from adjacent nonindustrial uses by one-half mile of vacant land designated for

Figure 1. Typical resource recovery facility



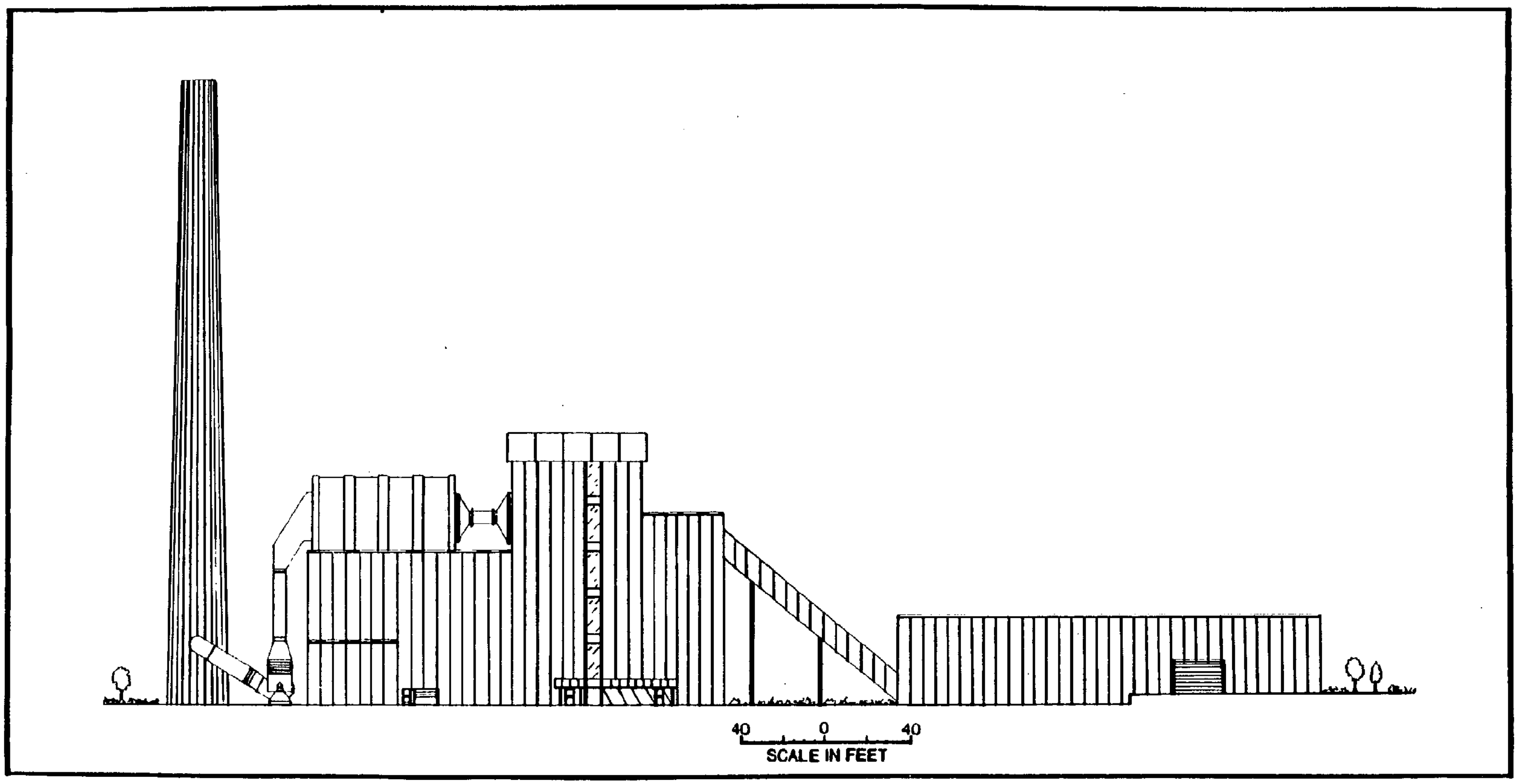
Source: Rogers, Golden & Halpern.

Figure 2. Site plan of a typical resource recovery facility



Source: Wheelabrator-Frye, Inc.

Figure 3. Elevation diagram of a typical resource recovery facility



Source: Wheelabrator-Frye, Inc.

landfilling or industrial development. It is well served by major New Jersey highways, including the New Jersey Turnpike and Route 18 and can be easily reached from most Middlesex County municipalities. In addition, the site is adjacent to the Raritan River and, therefore, accessible to barges serving any possible waterfront transfer stations.

USE OF THE GUIDEBOOK

Prior to review of a proposal for development of an RRF, municipal officials should become familiar with the function and impacts of resource recovery so that they can make responsible decisions and recommendations in a timely manner. This guidebook is intended to help municipal officials in accomplishing this task.

The guidebook contains summary matrices of probable direct and indirect environmental impacts of the RRF and the transport system. By reviewing the matrices and following the procedure described below, those municipalities reviewing a proposal for an RRF will be well prepared to make decisions based on probable environmental impacts.

Guidelines

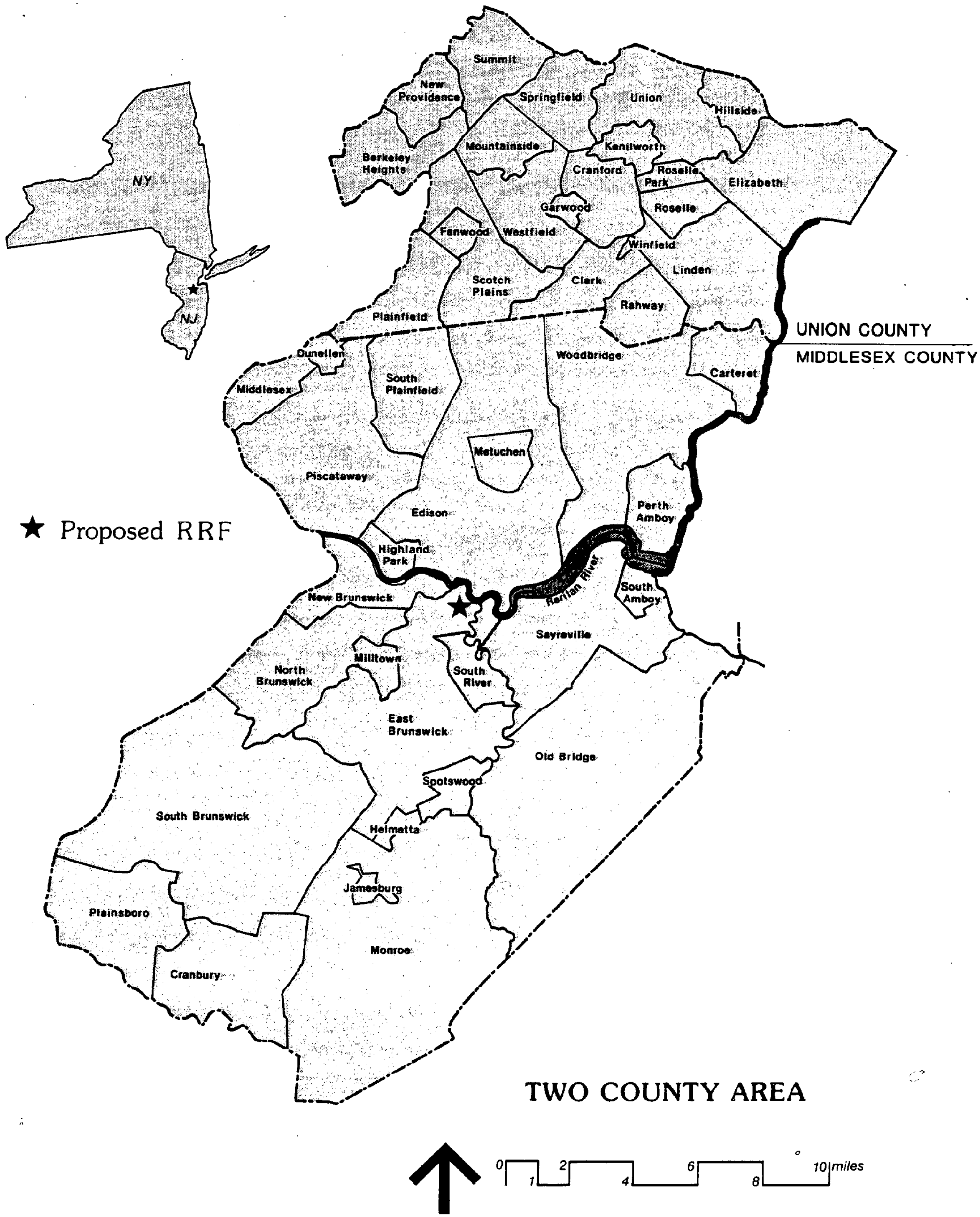
The summary matrices of the direct and indirect impacts are to be used to identify the different development activities associated with site acquisition, site preparation, and the construction, operation, and maintenance of the proposed facility and to relate these activities to the impacted environmental factors. The symbols in each matrix describe the potential effect in terms of short-term, long-term or either short term or long term impacts. The relative significance of each effect may generally be the same for most facilities or it may vary from one location to the next, depending on the relationship of the site to other uses, background conditions of the air and water, and other site-specific considerations. Using the matrices to identify potential environmental impacts, the steps listed below should be followed to ensure completion of a thorough environmental assessment.

- o Determine who is responsible for performing each factor assessment. Distinguish between those that can be done in-house and those whose assessment requires the aid of federal and state personnel or private consultants.

- o Contact those state and federal agencies identified as having legal responsibility for assessment to determine the results of the assessment(s) and the techniques used.

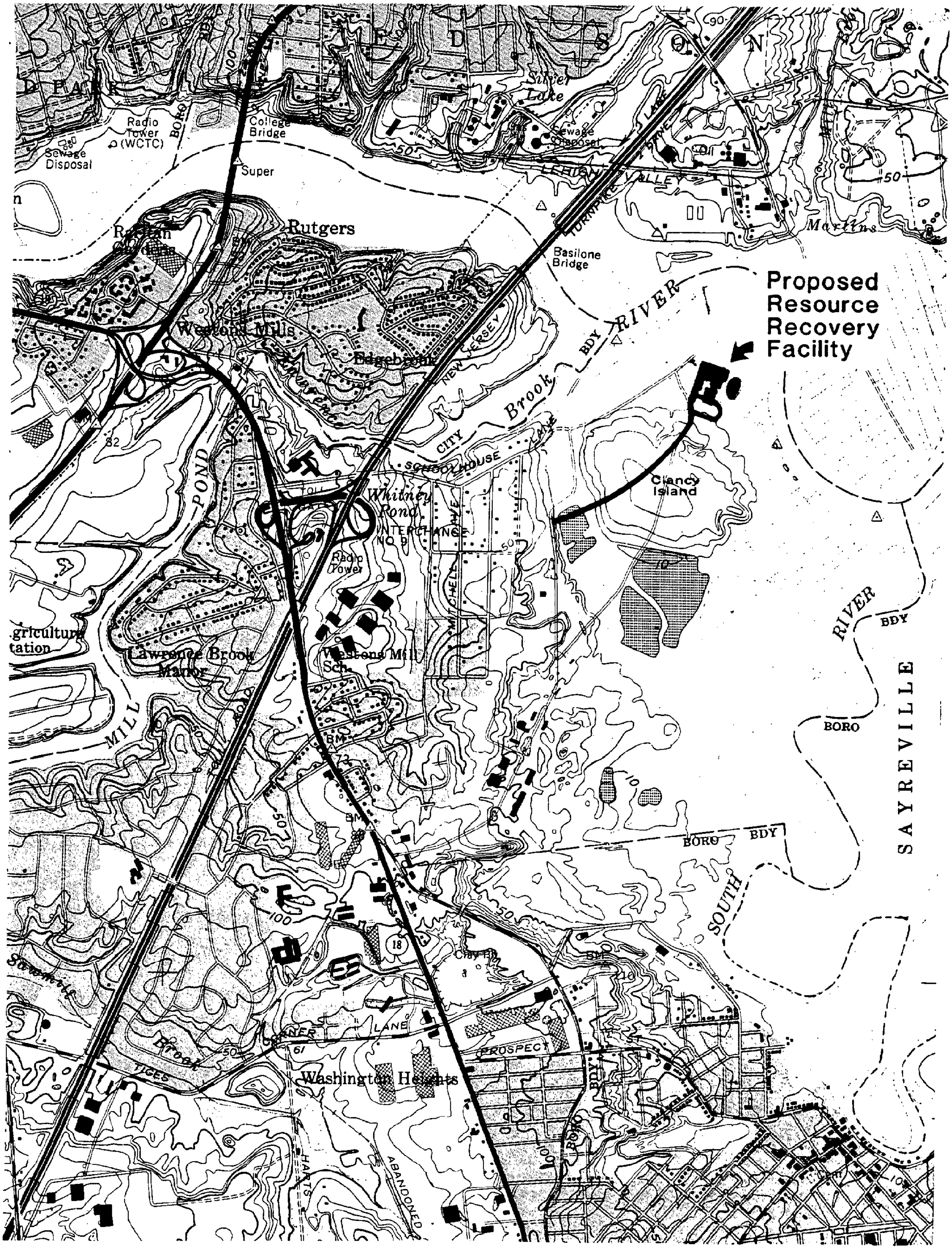
- o Determine the data, skills, and equipment required for estimating unassessed effects of development by consulting the corresponding sections of each chapter.

Figure 4. Regional setting of proposed resource recovery facility



Source: Rogers, Golden & Halpern.

Figure 5. Location of proposed resource recovery facility



Source: US Geological Survey, 1970.

- o Determine the type of appropriate analysis to be applied. Consider the availability and limitations of types of skills, time, funds and analytical techniques.
- o Determine data that should be required from the facility's developer.
- o Estimate effects. The estimation procedures entail data collection and measurement and often field investigation.
  - Determine level of development effect (estimation or measurement).
  - Determine whether effect is positive or negative.
  - Determine duration of primary effect (temporary, permanent, or actual duration, if known).
  - Determine how and to what extent effect can or should be mitigated.
  - When possible, determine the dollar cost of mitigation.
  - Estimate the degree of effect on a scale of 1 to 5 (least to most).
  - Estimate the degree of importance of effect on a scale of 1 to 5 (least to most).
  - Comment upon any aspect of the effect or the evaluation process.

CHAPTER 2. ENVIRONMENTAL ASSESSMENT GUIDEBOOK

A METHODOLOGY FOR ASSESSING ENVIRONMENTAL IMPACTS

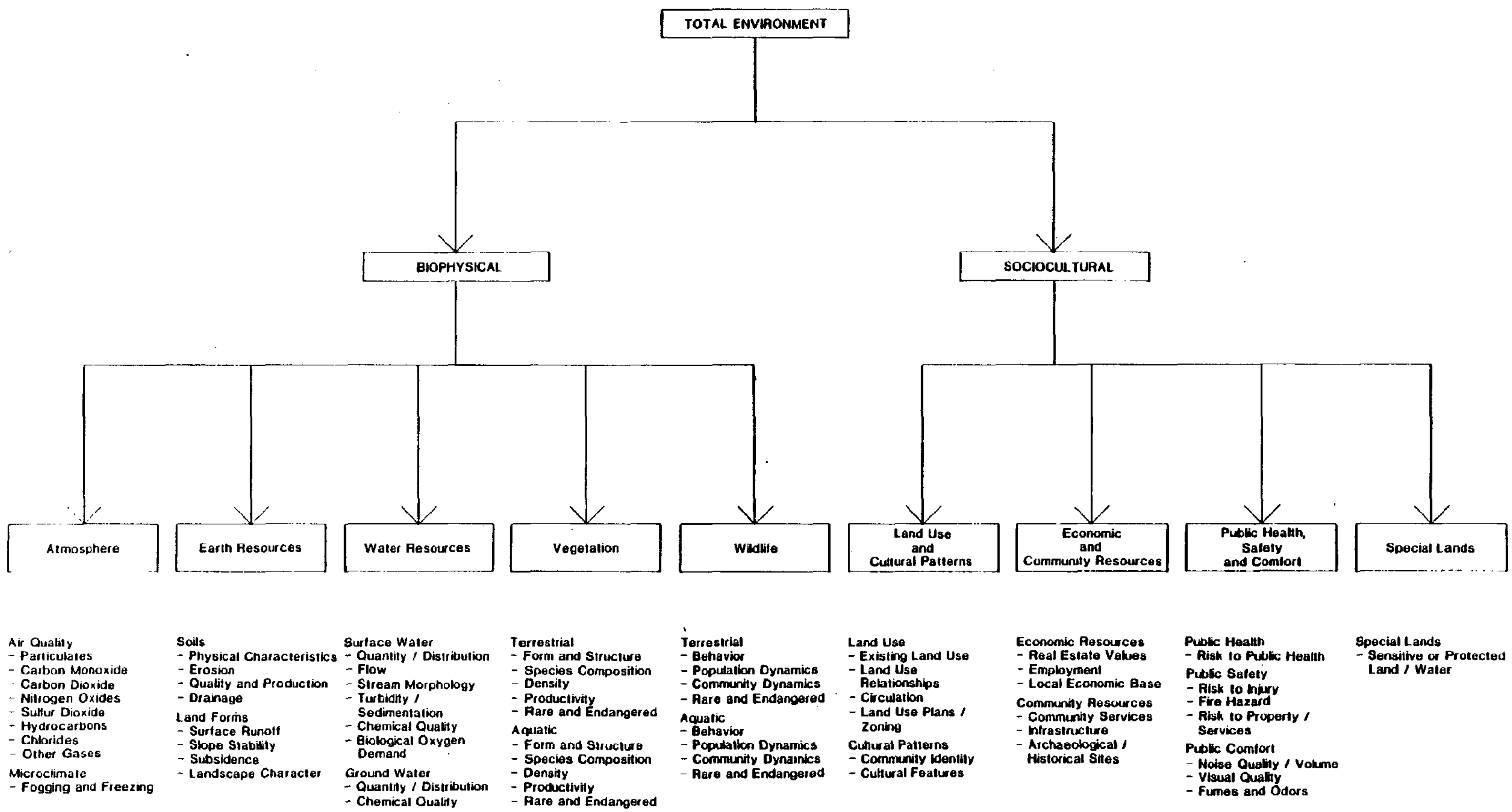
Introduction to Environmental Assessments

This guidebook presents a general methodology for assessing the environmental impacts of an RRF and the related modes of transporting solid wastes to a facility. Before focusing on the specific effects of an RRF and the trucking and barging of solid wastes, it is useful to review environmental assessments in general. The purpose of an environmental assessment is to provide a base of information and analytical techniques by which the impacts of development activities can be assessed. It consists of the following steps: (1) describing the present baseline conditions of the biophysical and sociocultural environments; (2) projecting future environmental conditions without the proposed development; (3) projecting future environmental conditions with the proposed development by estimating the environmental impacts of development activities; and (4) comparing the results of steps 2 and 3 and detailing possible mitigative actions.

Environmental Baseline Conditions

The description of the environmental baseline conditions proceeds by first defining the boundaries of the study area and then identifying and describing the various components of the biophysical and sociocultural environment within the study area. The structural components of the biophysical and sociocultural environment are presented in figure 6, which structurally organizes environment factors and facilitates the identification of areas where impacts may occur. Ideally, the environmental components should be described in sufficient detail that information is available to assess the various impacts and prepare informative baseline descriptions. Therefore, the appropriate study area boundary for each environmental component is dependent on the development activities under consideration; for a single study, they may range from the soil characteristics of a specific parcel of land to the regional air quality over many square miles. Much of the necessary data can often be extracted from various sources, although in some cases monitoring a specific component is necessary if data are lacking and it is anticipated that the environmental component will be significantly impacted.

Figure 6. Environmental components



Source: Rogers, Golden & Halpern.

Future Environmental Conditions Without the Proposed Development

In many cases the projection of future environmental conditions without the development is an extrapolation of historic trends and present conditions in the study area. However, all projections must consider future developments that are likely to occur and are independent of the development under study; in general, consideration must be given to population changes, expected residential, commercial, and industrial developments, and probable changes in land and water uses. Local, regional, and state agencies prepare documents for planning purposes that give projections and other relevant information, and these documents often contain most of the necessary data. All assumptions used in projecting future conditions should be clearly stated, and dissimilar assumptions that result in different projections should be noted.

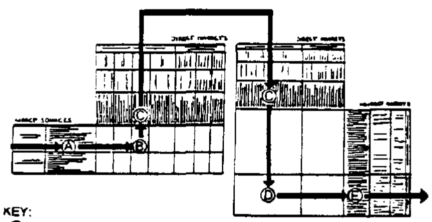
Future Environmental Conditions With the Proposed Development

The projection of future environmental conditions with the proposed development involves the major analytical portion of the methodology. It focuses on assessing the impact of each development activity on the environmental components. Development activities produce disturbances that result in ultimate effects on the ecosystems of the biophysical environment and the systems of the sociocultural environment. These ultimate effects, whether salutary or deleterious to environmental systems, are the environmental impacts of development activities.

The assessment begins by identifying and defining the specific development activities associated with each phase of development, including predevelopment activities, construction and implementation activities, and operation and maintenance activities. The impacts of these activities are evaluated through the use of an impact matrix that presents the separate development activities and the potentially impacted environmental components (see figure 7). The matrix permits the associations between each development activity and each environmental component to be shown graphically. The impacts are either short term, long term, or both: short-term impacts are episodic and generally occur during the predevelopment or construction and implementation phases, or within the first year of the development's operation, while long-term impacts are expected to occur throughout the development's existence, or longer. Some impacts have both long-term and short-term characteristics.

The impact matrix is actually two matrices, one displaying direct impacts and the other indirect impacts. Direct impacts are the environmental effects directly attributable to an activity: for example, site preparation activities might increase erosion on the site. If the erosion increases soil runoff into an adjacent stream, then the erosion's effects (which are essentially direct impacts) on the stream's turbidity/sedimentation and biological quality would be indirect impacts of site preparation activities.

Figure 7. Impact matrix format for a resource recovery facility



KEY:

Ⓐ READ IN IMPACT SOURCE
Ⓑ LOCATE INTERSECTION WITH DIRECT IMPACT
Ⓒ READ IN CORRESPONDING DIRECT IMPACT
Ⓓ LOCATE INTERSECTION WITH INDIRECT IMPACT
Ⓔ READ OUT INDIRECT IMPACT

DIRECT IMPACTS

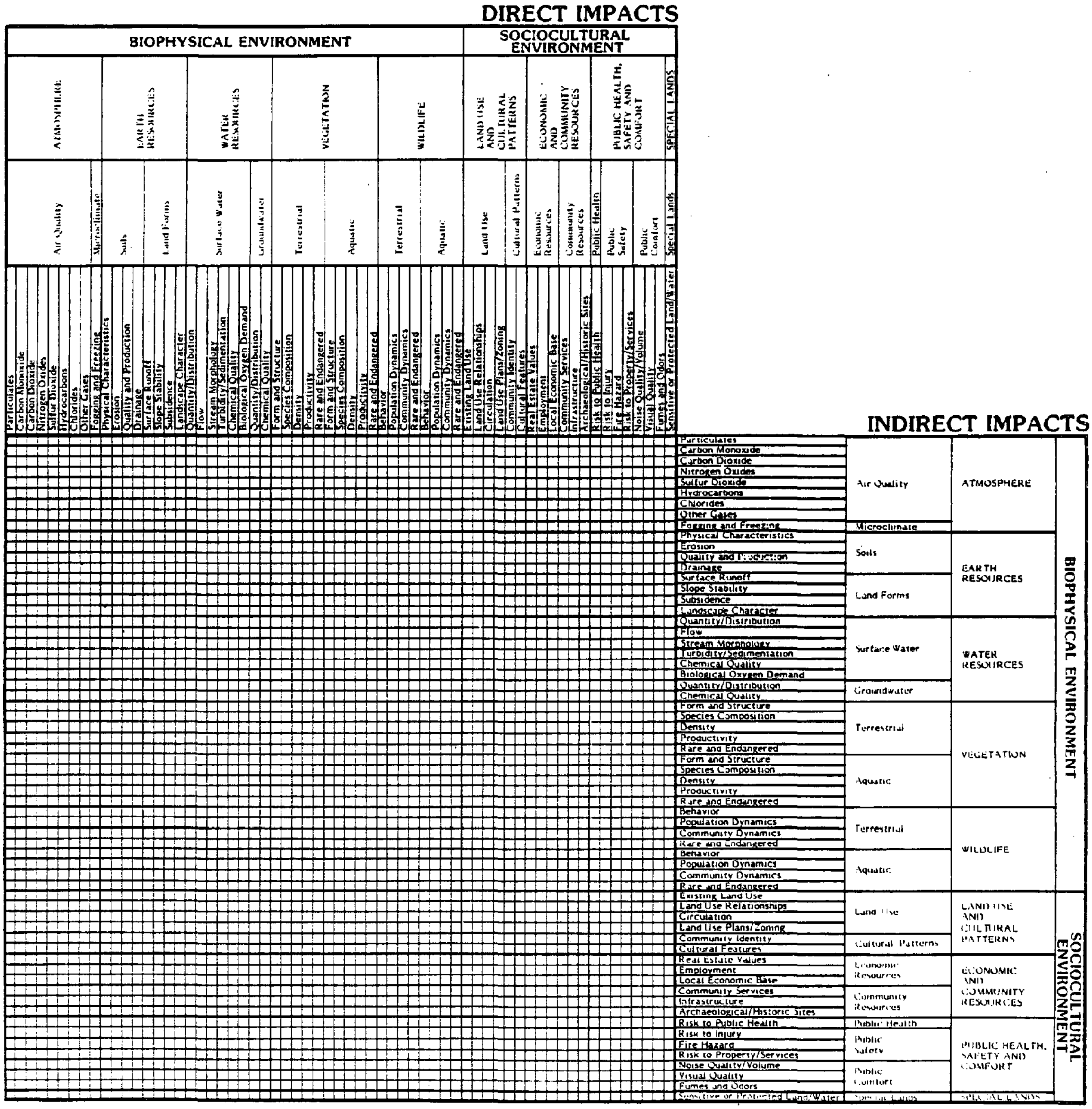
IMPACT SOURCES

		BIOPHYSICAL ENVIRONMENT																																										SOCIOCULTURAL ENVIRONMENT																			
		ATMOSPHERE									EARTH RESOURCES								WATER RESOURCES								VEGETATION										WILDLIFE								LAND USE AND CULTURAL PATTERNS						ECONOMIC AND COMMUNITY RESOURCES						PUBLIC HEALTH, SAFETY AND COMFORT							SPECIAL LANDS
		Air Quality								Microclimate	Soils				Land Forms				Surface Water						Groundwater		Terrestrial					Aquatic					Terrestrial				Aquatic				Land Use				Cultural Patterns		Economic Resources			Community Resources			Public Health	Public Safety			Public Comfort			Special Lands
		Particulates	Carbon Monoxide	Carbon Dioxide	Nitrogen Oxides	Sulfur Dioxide	Hydrocarbons	Chlorides	Other Gases	Fogging and Freezing	Physical Characteristics	Erosion	Quality and Production	Drainage	Surface Runoff	Slope Stability	Subsidence	Landscape Character	Quantity/Distribution	Flow	Stream Morphology	Turbidity/Sedimentation	Chemical Quality	Biological Oxygen Demand	Quantity/Distribution	Chemical Quality	Form and Structure	Species Composition	Density	Productivity	Rare and Endangered	Form and Structure	Species Composition	Density	Productivity	Rare and Endangered	Behavior	Population Dynamics	Community Dynamics	Rare and Endangered	Behavior	Population Dynamics	Community Dynamics	Rare and Endangered	Existing Land Use	Land Use Relationships	Circulation	Land Use Plans/Zoning	Community Identity	Cultural Features	Real Estate Values	Employment	Local Economic Base	Community Services	Infrastructure	Archaeological/Historic Sites	Risk to Public Health	Risk to Injury	Fire Hazard	Risk to Property/Services	Noise Quality/Volume	Visual Quality	Fumes and Odors	Sensitive or Protected Land/Water
PRE-OPERATIONS ACTIVITIES	Right-of-way acquisition: Public																																																															
	Right-of-way acquisition: Private																																																															
	Site preparation: Relation to existing improvements																																																															
	Access road construction																																																															
	General construction: Equipment operation																																																															
	General construction: Material delivery and handling																																																															
	General construction: Disposal of waste																																																															
	Clearing: Structural demolition																																																															
	Clearing: Vegetation removal and disposal																																																															
	Earthwork: Pavement breaking																																																															
	Earthwork: Rock fracturing																																																															
	Earthwork: Cut and cover																																																															
	RRF building construction																																																															
	Road construction																																																															
OPERATION AND MAINTENANCE ACTIVITIES	Existence of improvements																																																															
	Waste disposal																																																															
	Solid waste or fuel spills																																																															
	Emission control																																																															
	Sanitary water system																																																															
	Process water system																																																															
	Boiler feedwater																																																															
	Boiler blowdown																																																															
	Process waste water treatment and recirculation																																																															
	Equipment maintenance																																																															
	Labor force																																																															
	Electricity generation																																																															

Legend:

Short-Term Impact
● Long-Term Impact
· Short- and Long-Term Impact

Source: Rogers, Golden & Halpern.


DIRECT IMPACTS
BIOPHYSICAL ENVIRONMENT
SOCIOCULTURAL ENVIRONMENT
ATMOSPHERE
EARTH RESOURCES
WATER RESOURCES
VEGETATION
WILDLIFE
LAND USE AND CULTURAL PATTERNS
ECONOMIC AND COMMUNITY RESOURCES
PUBLIC HEALTH, SAFETY AND COMFORT
SPECIAL LANDS
INDIRECT IMPACTS
Particulates
Carbon Monoxide
Carbon Dioxide
Nitrogen Oxides
Sulfur Dioxide
Hydrocarbons
Chlorides
Other Gases
Fogging and Freezing
Physical Characteristics
Erosion
Quality and Production
Drainage
Surface Runoff
Slope Stability
Subsidence
Landscape Character
Quantity/Distribution
Flow
Stream Morphology
Turbidity/Sedimentation
Chemical Quality
Biological Oxygen Demand
Quantity/Distribution
Chemical Quality
Form and Structure
Species Composition
Density
Productivity
Rare and Endangered
Form and Structure
Species Composition
Density
Productivity
Rare and Endangered
Behavior
Population Dynamics
Community Dynamics
Rare and Endangered
Behavior
Population Dynamics
Community Dynamics
Rare and Endangered
Existing Land Use
Land Use Relationships
Circulation
Land Use Plans/Zoning
Community Identity
Cultural Features
Real Estate Values
Employment
Local Economic Base
Community Services
Infrastructure
Archaeological/Historic Sites
Risk to Public Health
Risk to Injury
Fire Hazard
Risk to Property/Services
Noise Quality/Volume
Visual Quality
Fumes and Odors
Sensitive or Protected Land/Water
Air Quality
Microclimate
Soils
Land Forms
Surface Water
Groundwater
Terrestrial
Aquatic
Terrestrial
Aquatic
Land Use
Cultural Patterns
Economic Resources
Community Resources
Public Health
Public Safety
Public Comfort
Special Lands
ATMOSPHERE
EARTH RESOURCES
WATER RESOURCES
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SPECIAL LANDS
BIOPHYSICAL ENVIRONMENT
SOCIOCULTURAL ENVIRONMENT

The relationship between direct and indirect impacts highlights the interrelatedness of environmental systems. A chain of effects may occur as a result of a single activity or a combination of various activities and may produce an impact that would not otherwise have occurred. It is necessary to recognize and understand and this is often the most difficult task in an environmental assessment.

Once the impacts are discerned, they must be described and assessed. If possible, the assessment should quantify the expected degree of an impact. In many instances, however, an impact can only be discussed in qualitative terms, although it may be possible to rate or compare qualitative changes. The description and assessment of environmental impacts can be facilitated by reviewing the impacts of similar activities in similar environmental conditions. Expert advisors and the Delphi method are often useful in assessing the severity of an activity's impact and deciding whether or not it is significant.

Comparison of Projected Environmental Conditions and Mitigative Actions

After future environmental conditions with and without the development have been projected, the two cases can be compared. Changes in environmental conditions can be identified, and major changes become readily apparent. According to the degree of projected impacts and the differences between the two future conditions, areas where actions to ease various deleterious impacts might be useful can be determined. The mitigative actions might range from minor predevelopment testing changes to major policy changes.

Limitations on the Comprehensiveness of Environmental Assessments

Although the steps of the environmental assessment methodology are quite logical and easy to understand, the actual process of investigating, measuring, and evaluating the potential effects of a development involves a variety of intangibles that limit the comprehensiveness of the assessment. Some limiting factors relate to the nature of the environmental impacts themselves, while others are associated with the nature of the assessment methods used to describe various impacts. To obtain a balanced perspective on the environmental assessment methodology, it is important to review the limitations of the process.

The Nature of Environmental Impacts

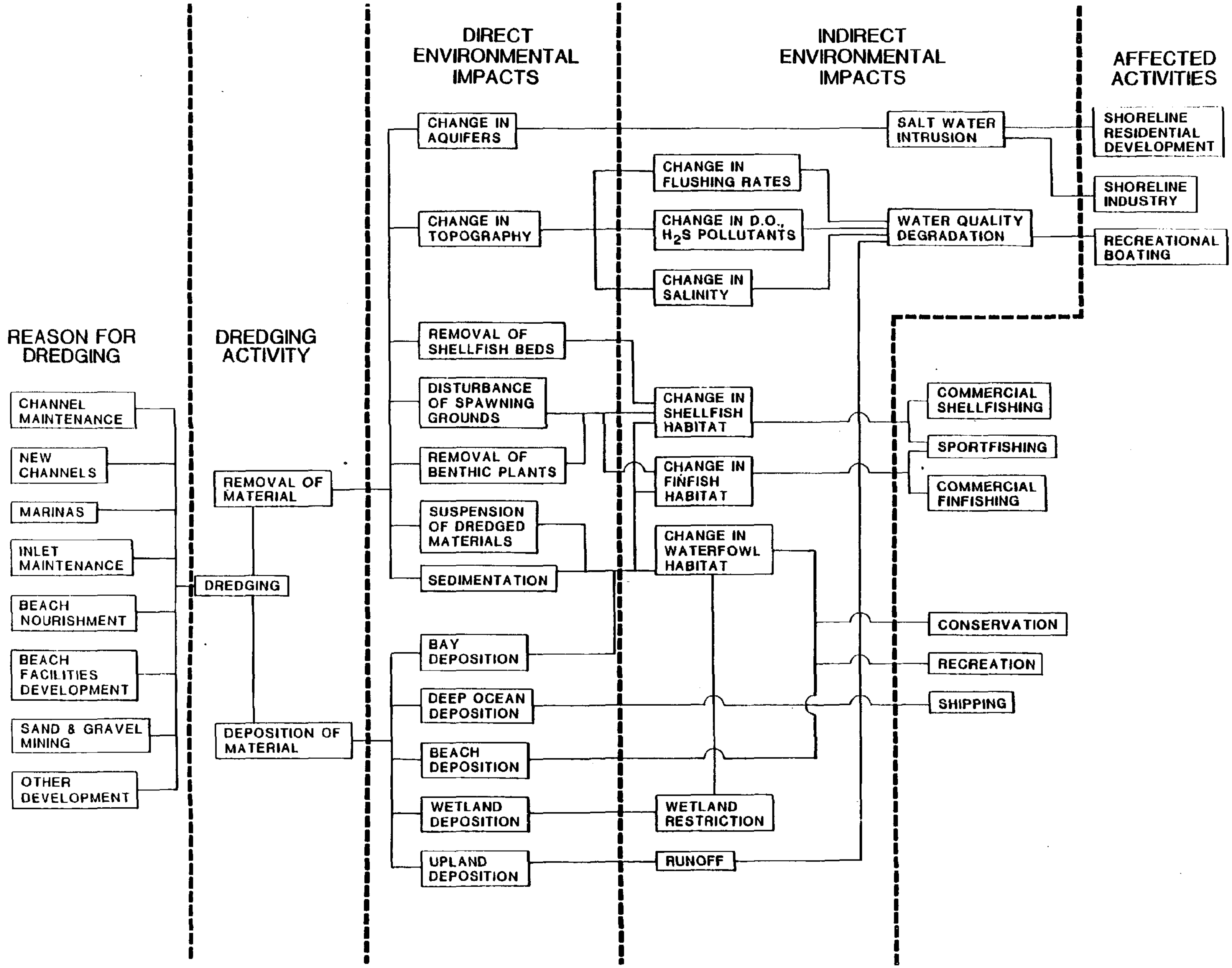
Environmental effects tend to occur in a complex web that reflects the interrelationships among the systems that make up the environment. In some instances, several effects can result from a single disturbance: dredging alone, for example, can set in motion a whole chain of consequences (see figure 8). Conversely, a number of separate activities may result in a single effect: excavation, vibration, and filling operations taken separately may have little environmental effect, but together they may cause landsliding. The complexity of this web of effects is the most pervasive limit on the scope of environmental assessments. Any assessment of environmental impacts must continually address the consequences of these interrelationships among environmental systems; in many cases the full impact of either one or a number of activities is not readily apparent.

Some natural environmental effects that are imperceptible or relatively insignificant when viewed from a single-project perspective may become more significant when the effects of several projects combine over time. Harmful environmental effects are often a function of long-term community growth rather than of one facility's development in particular. For example, in evaluating the effect of an industrial facility on air quality, it might be found that the ambient concentration standard for a particular pollutant is exceeded. In this situation, a facility's emission is enough to push air quality, which was previously at the safety margin, to an unsatisfactory level. A facility's emission may be less than those of surrounding facilities, but the collective effect exceeds the standard.

The dynamic, constantly changing natural and sociocultural environment does not allow exact prediction of future baseline conditions for any given factor; that is, ambient biophysical and current sociocultural conditions will change over time. Because the assessment process is predictive, the potential effects of a development are often postulated on baseline data derived from conditions at the time of assessment, the assumption being that future conditions will be essentially the same as present ones. The data used as a baseline, however, may change over time, even without the effect of proposed activities (see figure 9). Change can occur naturally; long-term climatic change, for example, may alter ambient conditions of riverflow and related factors over the years. In addition, man-made changes will occur within the study area. Estimates of future residential, commercial, and industrial developments, changes in land and water uses, and population changes are often based on past trends and various planning documents, but they are only projections, not certainties. Estimating the collective environmental effects of a particular development combined with projected and future developments involves a fair number of assumptions.

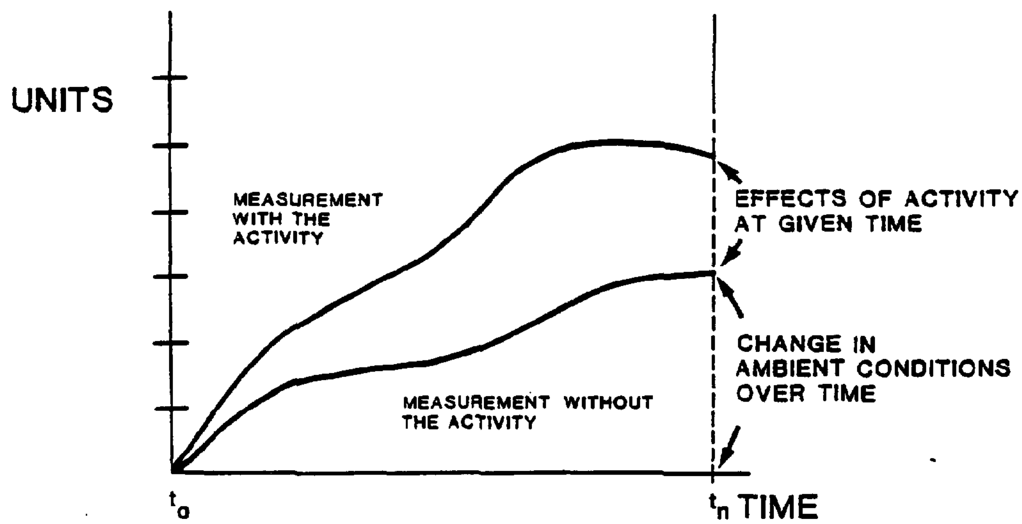
In an ideal situation, a development's harmful effects could be nullified and base environmental conditions could be restored (if restoration was desirable). Usually, however, no new development is wholly reversible. In some cases, reversals may be effected by natural forces (e.g., biodegradation) or by clean-up efforts. Mitiga-

Figure 8. Environmental chain of effects as a result of dredging



Source: Rogers, Golden & Halpern.

Figure 9. Measurement of environmental conditions over time, with and without activity



Source: Rogers, Golden & Halpern.

tive techniques may also be employed to modify or forestall projected impacts. Some impacts of development, however, are totally irreversible. When these occur, environmental factors that are lost or altered may never be retrieved.

The Nature of Environmental Assessments

The nature of environmental assessments and the current state of assessment methods impose some limitations on the process of identification, measurement, and evaluation of development effects. First, the accuracy of measurement techniques differs considerably from factor to factor. Second, techniques may rely on either quantitative or qualitative analysis. Finally, methods vary widely in terms of sophistication. These differences should be borne in mind when assessments are compared and weighed in the final decision-making process. Quantitative measurements express actual or estimated changes in a particular factor in units of measure such as feet, tons, or gallons per day. Not all environmental factors can be quantitatively assessed, however. Those that cannot be given a meaningful quantification are nonetheless important and must be evaluated qualitatively.

The need for qualitative measurements may arise for one of a variety of reasons. A factor may not be well defined because of its inherent characteristics, as is the case with visual quality. Or its precise relationship to an environmental system may be unknown, often as a result of the complex interrelationship of environmental components in the system; this presents a problem when judging, for example, the effect of a pollutant or a combination of pollutants on a stream system. Finally, it may be necessary to assess the value of a natural resource that will be impacted by qualitatively rating or comparing it to similar resources. For example, the impact of draining and filling a wetland can be viewed in terms of its loss, and there are methods that qualitatively compare and rate wetlands. Qualitative measurements may be expressed as a scale (e.g., 1 to 10) or as a ranking (e.g., high, medium, low). Opinions of experts or survey results are often used to formulate qualitative measurements.

Ideally all factor assessments would be comparable in level of detail and would be translatable into meaningful common units of measure for the purpose of producing a systematic and mathematically defensible decision. However, measurement and evaluation methods are at different levels of sophistication for different environmental factors. In some cases, such as assessments of air and water quality changes and flood prediction, methods are fairly advanced; in others, such as vegetation hazard assessment, they are less so. Some methods, even those that can be quantified, are not fully developed and rely largely on subjective judgment.

A General Method for Assessing the Environmental Impacts of a Resource Recovery Facility and a Solid Waste Transport System

Establishment of Environmental Baseline Conditions

The first step in establishing the environmental baseline conditions is to define the study area. The study area for an RRF is the proposed land on which it will be located and the surrounding area that may be impacted. The components of a transport system include the transportation mode (trucking, barging, railroad, etc.), transfer stations, storage areas, and transported wastes and the corresponding study area includes the service areas, the amount of waste they generate, capacities and locations of existing and planned transfer stations, the location of the RRF, the transport route alternatives to be considered, refuse fleet characteristics, and truck maintenance procedures.

Service areas are those areas from which solid waste will be collected and transported to the RRF. The service area boundaries generally, though not always, conform to the boundaries of municipalities. The county solid waste management plan will identify the areas that will be served.

The amount of waste generated by the service areas can be obtained from data supplied by county solid waste management programs or from data submitted by haulers.

Existing transfer stations to be used in the collection system will be identified in the proposed plans for the RRF, and their capacities can be obtained from solid waste management programs. Information on the locations and capacities of planned transfer stations will be contained in the county solid waste management plan.

The location of an RRF will also be found in the proposed plans. In many cases a proposed RRF site will be on or adjacent to a solid waste landfill site. (Information on the RRF location is necessary to determine where the trucks will converge.)

The transport routes or alternative routes may be described in the RRF plans; however, if they are not and an RRF is to be located at a landfill site, then the transport routes for the overlapping service areas can be assumed to remain the same. Transport routes for the new areas to be served must be determined if none are contained in the RRF's plan. Any necessary road improvements must also be noted.

If barging is being considered, the Army Corps of Engineers can supply data on channel depths and widths as well as dredging activities. Fleet characteristics to be noted include the number of trucks or barges, their capacities and ages, and the expected number of trips per day. Future fleet additions that may be needed because of attrition and increased volumes of solid wastes must also be considered.

Most of the needed information on fleet characteristics can be obtained from solid waste management plans and from haulers. It may be necessary to estimate additional needs on the basis of projected population and commercial increases within the various municipalities. Vehicular maintenance procedures can be obtained from the vehicle owners or vendors.

Most, if not all, of this information can be obtained from county solid waste management plans or through consultation with solid waste program officials; however, precise identification of routes, the locations of future transfer stations, and the location of an RRF are dependent upon the degree to which plans for the future collection system have been finalized. If some of the collection system components have only been proposed, then an environmental assessment can be used to estimate the impacts associated with the different proposals.

With the above information, the locations of the RRF, the transfer station(s) and the transport routes can be mapped to provide the base for delineating the study area boundaries (or, if applicable, the boundaries for the various alternatives). However, the boundaries for which baseline information is needed will change according to the environmental component that is to be described. For most purposes, information about the area immediately surrounding the RRF and transfer station sites and the transport routes will be sufficient. Focus at the local level will satisfy the information demands for most components. Exceptions include air quality, which should be reviewed on a regional level, and noise quality and land use, which should consider an area up to a minimum of four hundred yards from the routes, transfer stations, and RRF site. The type of data needed to prepare baseline conditions depends on the environmental component.

The information about the atmosphere that should be collected consists of regional air quality data on nitrogen oxides and hydrocarbon levels and data on local levels of carbon monoxide. Information on audible noise levels is also important, but is rarely collected. In some cases where data are lacking and residential developments or sensitive land uses (e.g., hospitals, schools, parks) are near collection routes or sites, it might be useful to establish monitoring stations to gather baseline data on audible noise levels.

Data on earth resources are needed for the RRF and transfer station sites where new construction will disturb the land. The geology of a site and its ability to support structures must be investigated. Geology is also directly related to groundwater hydrology. A site analysis will reveal the physical characteristics of the soils, any erosion, the degree of slopes, and the character of the landscape. Information on geologic characteristics often can be obtained from the US Geological Survey (USGS), the NJ Department of Environmental Protection (NJDEP), or local colleges. Information on soil characteristics can be obtained from soil survey reports published by the Soil Conservation Service, US Department of Agriculture.

Whether baseline information on water resources is needed depends on the location of surface waters and groundwater recharge areas in relation to roads used by trucks, barging channels, transfer station sites, and the RRF site. Runoff may be a problem if a stream is adjacent to construction sites or a road that will be heavily used by haulers and there is little or no vegetative buffer between the site or road and the stream. In this case it will be useful to obtain water quality data, including information on chemical quality, biological quality, and turbidity/sedimentation for the stream. The 208 water quality plan for the region should provide this information. Additional information can be obtained from other planning documents and the USGS. If an RRF or transfer station site is within a groundwater recharge area, then groundwater quality data will be useful. Groundwater quality data, which are based on well records, can be obtained from the USGS or from county planning offices. If the aquifer is a source of drinking water and no wells are near the site, it might be advisable to perform a test drilling to check the water quality of a sample.

It should not be necessary to collect baseline data on vegetation and wildlife unless it is proposed to build either the RRF or the transfer station in a rural area. However, lists of rare, endangered, or threatened species should be obtained and reviewed.

The consideration of visual quality is relevant to an RRF and transfer station, and the existing visual experience can easily be verified by photographs. The visual quality along roads would be of concern only for roads where present truck traffic is light—for example, feeder roads near a proposed RRF.

Besides visual quality, other relevant baseline information for the sociocultural environment includes property values surrounding a proposed RRF and transfer stations and along routes heavily used by haulers, locations of sensitive land uses, traffic circulation patterns, road conditions, and accident records of trucks hauling solid wastes. If barging is being considered, competing uses for the river channel are important. Local realtors can be a good source of information about sales trends and historic and current selling prices of real estate. Appraisers are experts who evaluate property values and assessed property values can be obtained from tax records. Sensitive land uses include hospitals, schools, recreational areas, and cultural centers. They can be identified from land use and tax maps and windshield surveys. Road capacity estimates and traffic counts, which should be available from the NJ Department of Transportation or county officials, help establish traffic circulation patterns. County or state officials should also be able to identify when and where traffic volumes, circulation patterns, and congestion are a problem. Current conditions of the roads on which truck traffic will be heaviest can be obtained from the NJ Department of Transportation and verified by windshield surveys.

Establishment of Future Environmental Conditions Without a Proposed Resource Recovery System and Transport System

The purpose of this step is to estimate the future conditions of the environmental components identified in the previous section by projecting present baseline data into the future. Regional air quality conditions are primarily dependent upon changes in commercial and industrial developments and vehicular emissions. The possibility of additional commercial and industrial developments can be checked by reviewing the maps and plans indicated above and by consulting with industrial development commissions and chambers of commerce. Projections of increased traffic flows may be available from the NJ Department of Transportation or county planning offices.

Extrapolations of present levels of carbon monoxide, nitrogen oxides, and hydrocarbons can be accomplished by reviewing projected growth rates and increased traffic flows. State Implementation Plans for air quality should also be consulted. Audible noise levels can be assumed to increase as traffic flows increase.

Future earth resources for proposed facility sites can be assumed to remain the same.

As mentioned above, it may be unnecessary to consider water resources. Where applicable, future surface water quality estimates can sometimes be obtained from 208 plans. Information on waterway traffic and channel maintenance is obtainable from the Army Corps of Engineers. Estimates of future groundwater quality may be available from the NJ Department of Environmental Protection or county planning offices. It may be necessary to estimate future water quality on the basis of projected developments.

Vegetation and wildlife considerations would be a concern only for nonurban areas, and in these cases they can be assumed to remain the same.

The visual quality of the facility site would be assumed to remain the same unless some other type of development occurred. The visual quality of collection roads would also remain the same unless increased traffic flows are projected or repairs or design changes to the roads are planned.

These projections must take into consideration future land use changes, which are often estimated by comparing local zoning maps and master plans with existing land use and projecting future growth. Projections of future property values can be obtained from a survey of knowledgeable local realtors, the judgment of appraisers, and, possibly, an extrapolation of historic assessed values of the specific parcel, comparable parcels, and adjacent lots. Local planners and realtors can be consulted for their perceptions about how growth is likely to proceed. Growth projections based on demographic and economic analyses may be available from the local planning board or

Chamber of Commerce. Discussions with officials in these agencies would also prove helpful. Once future land use and demographic changes have been estimated, projections can be made of the future condition of the necessary environmental components. Future changes, if any, in sensitive land uses can be obtained from local planning and zoning offices. Projections of future traffic volumes, flow patterns, and road conditions should be available from the NJ Department of Transportation and local county planning offices. Traffic accidents can be expected to increase in proportion to increased traffic flows.

Assessment of the Environmental Impacts of a Resource Recovery Facility and Transport System

This task is the major analytical portion of an environmental assessment. The primary technique for assessing potential impacts is the use of impact matrices that indicate relationships between specific activities related to the transport of solid wastes and the RRF and the appropriate environmental components. The activities, referred to as impact sources, are divided into preoperation activities and activities associated with the operation and maintenance of the proposed transport system and RRF. Impacts can be short term, long term, or both. Short-term impacts are those that occur only during the preoperation stages or up to a year after operations begin. Long-term impacts are expected to occur as long as the facility is operating, or longer. For example, if an intersection must be improved to accommodate increased truck traffic to an RRF, then the noise generated during construction is a short-term audible quality impact, while the resulting increased truck traffic would have a long-term impact on the visual and, possibly, the audible quality. Impacts may also be either direct or indirect, depending on whether they are directly attributable to an activity or occur because of the interrelationship of environmental components. For example, the site preparation for a transfer station might increase erosion on the site; this would be a direct impact. If the erosion increased soil runoff into an adjacent stream, then its effect on the stream turbidity/sedimentation and biological quality would be an indirect impact.

Environmental assessments are inherently multidisciplinary, requiring the use of skills in variety of biophysical and sociocultural fields. Table 1 is a summary of assessment methods. It displays the multidisciplinary nature of environmental assessments by presenting the various environmental components, the effects to be measured, measurement units, the measurement technique, the assessment responsibility, and sources of technical assistance.

The following section discusses the environmental components and the development and operational activities that may affect them. It will deal in more detail with the information outlined in table 1.

Table 1. Summary of assessment methods

Factor	Effects To Be Measured	Measurement Units	Measurement Technique	Assessment Responsibility	Sources of Technical Assistance
ATMOSPHERE - AIR QUALITY	Change in concentrations of particulates, carbon monoxide, carbon dioxide, nitrogen oxides, sulfur dioxides, hydrocarbons, chlorides, and other gases	Gases in milligrams per cubic meter or parts per million; particulates in micrograms per cubic meter	Standard methods, computer models, stack testing	DEP Bureau of Air Pollution Control EPA—Air Pollution Control County air pollution unit	DEP, EPA, Lung Association
ATMOSPHERE - MICROCLIMATE	Fogging and freezing				
EARTH RESOURCES/SOILS	Physical characteristics, erosion, quality and production, drainage	Specific to each variable	USDA Texture class, physical and chemical analysis, soil property and soil survey interpretations	SCDs	DEP Geological Survey
EARTH RESOURCES/LAND FORM	Surface runoff, slope stability, subsidence, landscape character	Specific to each variable	Mapping, ranking of sites, soil property and soil survey interpretation	SCDs	DEP Geological Survey
WATER RESOURCES/SURFACE WATER	flow, turbidity/sedimentation, chemical quality, BOD, stream morphology	Flow = cubic ft/sec (CFS), turbidity = Jackson Turbidity Unit, Chemical quality = mg/l, BOD = mg/l, stream morphology = mapped channel changes	Standard methods, laboratory analysis	DEP of Water Resources and, Division of Coastal Resources, EPA	DEP, EPA, local watershed associations
WATER RESOURCES/GROUNDWATER	Quantity/distribution, chemical quality	Specific yield - quantity of water in soil/rock, permeability - how readily soil/rock pores transmit water mg/l	Hydrogen, water table analysis, lab analysis	DEP/township	DEP Division of Water Resources, DEP, local watershed associations
VEGETATION/TERRESTRIAL	Change in form and structure, species composition, density, productivity, rare and endangered species	Number and type of plants - species diversity index number of plants destroyed/unit area presence or absence	Field investigation, vegetation mapping	NJDA, Division of Parks and Forestry, DEP	NJDA, DEP
VEGETATION/AQUATIC	Change in form and structure, species composition, density, productivity, rare and endangered species	Species diversity index, number of plants/unit area, pounds/acre, presence, or absence	Field investigation, vegetation mapping	DEP NJDA, Division of Coastal Resources, and Division of Marine Services	DEP, American Littoral Society
WILDLIFE/TERRESTRIAL	Change in abundance, habitat, rare and endangered species	Numbers of wildlife degree of habitat change, species diversity index	Field investigation, extrapolation of past results, ranking of habitat disruption	DEP, Bureau of Wildlife Management	U.S. Fish and Wildlife Service, SCD Bureau of Wildlife Management, DEP Division of Fish, Game and Wildlife and Bureau of Shellfisheries
WILDLIFE/AQUATIC	Change in abundance, habitat, rare and endangered species	Numbers of wildlife, degree of habitat change, species diversity index	Estimates and field investigation, extrapolation of past results, ranking of habitat disruption	Division of Marine Services and DEP Division of Fish, Game & Shellfisheries,	DEP Division of Fish, Game and Wildlife, Bureau of Shellfisheries, and Division of Coastal Resources, National Wildlife Federation, American Littoral Society

Key:
BOD Biological Oxygen Demand
EIS Environmental Impact Statement

State agencies
DCA Department of Community Affairs
DEP Department of Environmental Protection
NJDA New Jersey Department of Agriculture

Federal agencies
EPA Environmental Protection Agency
OSHA Occupational Safety and Health Administration
SCD Soil Conservation District
USDA United States Department of Agriculture

Table 1. Summary of assessment methods (cont'd)

Factor	Effects To Be Measured	Measurement Units	Measurement Technique	Assessment Responsibility	Sources of Technical Assistance
LAND USE & CULTURAL PATTERNS--LAND USE	Change in existing land use, land use relationship, circulation, land use plans/zoning	Land use categories, zoning districts	Comparison of existing and proposed land use, land capability analysis, master plan	County and township zoning and planning boards	DEP, municipal zoning and planning boards, environmental commission
LAND USE & CULTURAL PATTERNS--CULTURAL FACILITIES	Change in community identity, cultural features		Questionnaires to township and county officials, informed individuals	County and township	
ECONOMIC & COMMUNITY RESOURCES--ECONOMIC RESOURCES	Change in real estate values, employment, local economic base	values in dollar, manpower figures	Historic trends, economic studies		
ECONOMIC & COMMUNITY RESOURCES--COMMUNITY RESOURCES	Change in community services, infrastructure, archeological/historical sites			Federal--funding agency, DEP Division of Parks and Forestry, Historic Sites, DCA, County and township zoning and planning board	Historic Sites Council, DEP, local historic society, DCA
PUBLIC HEALTH, SAFETY & COMFORT--PUBLIC HEALTH	Risk to public health	Theoretical number of potential injuries, type of possible contamination, health risk, etc.	Risk/benefit analysis, analysis at site, estimate based on current and future land use	Department of Health, DEP, OSHA (worker safety)	Dept. of Health, DEP, county and local health departments
PUBLIC HEALTH, SAFETY & COMFORT--PUBLIC SAFETY	Risk to injury, fire hazard, risk to property/services	Theoretical number of injuries, potential for risk	Risk/benefit analysis	Dept. of Health, DEP, OSHA, Local Fire Marshal	Dept. of Health, DEP, OSHA, local fire departments, local and county health dept.
PUBLIC HEALTH, SAFETY, AND COMFORT--PUBLIC COMFORT	Noise quality/volume, visual quality, fumes, and odors	Decibels, degree of change - most pleasing - least pleasing, ppm on 24, 12, 3 and 1 hr basis	Mathematical models, site survey, viewer survey, mathematical dispersion models	DEP Office of Noise Control, Bureau of Air Pollution Control	DEP Office of Noise Control, and Bureau of Air Pollution Control, EPA, Highway Administration, Landscape Architecture, Lung Association
SPECIAL LANDS	Change in sensitive or protected land/water	Degree of change chemically, physically, in wildlife habitat, in attraction/accessibility to public	Site survey, lab analysis, questionnaire, spot count	DEP - wetlands, coastal zone, forestry and parks EPA - wetlands, coastal zone, forestry and parks	EPA, DEP, SCD, watersheds, conservation foundations

Key: BOD Biological Oxygen Demand
EIS Environmental Impact Statement

State agencies

DCA Department of Community Affairs
DEP Department of Environmental Protection
NJDA New Jersey

Federal agencies

EPA Environmental Protection Agency
OSHA Occupational Safety and Health Administration
SCD Soil Conservation District
USDA United States Department of Agriculture

IMPACTS OF PREOPERATIONAL AND OPERATIONAL ACTIVITIES ON ENVIRONMENTAL COMPONENTS

Introduction

This section describes each environmental component, related direct and indirect impacts that could result from various preoperational and operational activities associated with an RRF and a transport system, and possible mitigative actions. Preoperational and operational activities are presented earlier in the chapter in figure 7. Chapter 3 contains matrices indicating impact relationships for the proposed resource recovery system in East Brunswick Township.

The environmental components discussed in this section are grouped according to the following categories:

- Biophysical Environment
  - Atmosphere
  - Earth Resources
  - Water Resources
  - Vegetation
  - Wildlife
- Sociocultural Environment
  - Land Use and Cultural Patterns
  - Economic and Community Resources
  - Public Health, Safety, and Comfort

Atmosphere

The atmosphere is the gaseous mass that surrounds the earth. Since this mass is constantly moving, atmospheric changes in one area may affect the atmosphere in other areas. For the purposes of this study, the important atmospheric conditions are air quality and the microclimate.

Air Quality

Air quality is analyzed in terms of particulates and specific gaseous molecules (carbon monoxide, carbon dioxide, nitrogen oxides, sulfur dioxide, hydrocarbons, chlorides, and other gases). The relative concentrations of the various atmospheric gases determine air quality, and its degradation occurs when specific gases surpass designated levels. Quite often regional conditions of poor air quality will be reversed once the impact source activity ceases since there is a constant flow and interchange of atmospheric gases. However, the retention of air pollutants depends, in part, on the dispersion properties of the area, including wind speed and inversion potential. In general, urban areas contain relatively poor ambient air quality conditions, concentrations of people who may be adversely affected, and poor dispersion characteristics. The maintenance of clean air is, of course, important to the healthy existence of all living organisms and biological systems. The levels of various particulate and gaseous pollutants are regulated by federal, state, and local regulations. Sources of air quality data, applicable regulations, and the agencies concerned with those regulations are presented in table 1.

Activities That Impact Air Quality

General construction: equipment operation. Construction equipment burning gasoline or diesel fuel will emit particulates, carbon monoxide, nitrogen oxides, sulfur dioxide, and hydrocarbons. In New Jersey, construction vehicles less than 6,000 lbs. are inspected once a year, similar to car inspections. A part of this inspection determines whether concentrations of carbon monoxide, hydrocarbons, and particulates are below maximum levels set by state law. Vehicles over 6,000 lbs. are not regularly inspected. Their maintenance is the responsibility of the owner, and state police spot-check the vehicles at their discretion. The state also regulates the sulfur content of fuel. It is unlikely that use of construction equipment will result in chronically higher levels of air pollution, since construction is limited in space and time and construction vehicles change as construction proceeds. Nonetheless, construction equipment can create high local concentrations of pollutants and contribute to overall pollutant levels that may already be at regulatory thresholds.

General construction: material delivery and handling. Materials used during the construction phase may contain volatile hydrocarbons. It is unlikely that these would be stored during construction in amounts that would be of concern to the state (NJAC 7:27-16). However, the municipality should require the site developer to exercise reasonable care in the storage, movement, and use of these substances and in disposition of spent containers.

Clearing: structural demolition. Demolition of unwanted structures can generate brief but locally intense concentrations of fugitive dust or particulates.

Clearing: vegetation removal. Clearing vegetation from a construction site removes the natural cover of soil so that the exposed surface is subject to wind action and the release of finer soil particles into the air. Generally, this impact on air quality will be addressed in a plan for soil erosion and sedimentation control submitted for certification by the local Soil Conservation District. Municipalities must condition approval of development on such certification.

Burning vegetation cleared from a site pollutes the air and is prohibited by state law (NJAC 27:1-2.3).

Earthwork: surface grading. When soil is dry, surface grading can raise dust particles. This impact on air quality may be addressed by the soil erosion and sedimentation control plan, although the plans usually focus on the action of surface water.

Temporary waste storage. The temporary storage of solid waste at an RRF or a transfer station in warm or hot weather can lead to the production and release of obnoxious odors.

Truck traffic and hauling. This activity results in a major impact on air quality. The combustion of gasoline and diesel fuel by automobiles and trucks produces particulates, hydrocarbons, carbon monoxide, sulfur dioxide, and nitrogen oxides. The volume of emissions depends largely on the age of the vehicle; older vehicles with worn engine components generate more pollution. This difference is illustrated in table 2, which presents average emission factors for a 1968 and a 1972 model vehicle operating in 1972. The type and mechanical condition of the vehicle, as well as the presence or absence of pollution control devices, will also influence emission volume. Tables 3 and 4 present federal standards (which apply to all vehicles built in or after 1975) for nitrogen oxides, hydrocarbons, and carbon monoxide.

Off-highway mobile sources such as helicopters, locomotives, and marine vessels may also be significant air pollution sources. Major emissions include carbon monoxide, hydrocarbons, and nitrogen oxides; particulates and sulfur oxides may also be produced as combustion by-products. Table 5 presents average emission factors for off-highway mobile sources.

Truck and barge towboat traffic in and around a transfer station site can have serious local impacts on air quality because of emissions from internal combustion engines, particularly if the transfer station is a large one and there is only one route leading to it. During state review of plans for a transfer facility, municipalities can protect air quality by asking that the estimation of area sources include the anticipated increase in truck traffic and that area sources be included in the air pollutant modeling required for permits to construct and operate. Traffic counts on New Jersey streets and highways are published in map form every year by NJDOT. Additional counts by vehicle type are made at regular counting stations as often as once a month. This background information is useful in establishing a picture of the relative impact a proposed solid waste facility will have on a small area on which solid waste trucks are converging. In addition, municipalities can check air pollution modeling efforts to make sure that actual air pollutant monitoring data are used and that the modeling year chosen for input is not characterized by climatological data atypical for the area.

Table 2. Emissions factors for highway mobile sources

Source	Emissions in grams per mile: Carbon monoxide	Hydrocarbons	Nitrogen oxides
Automobile (gasoline)			
1968	63.7	6.33	4.44
1972	36.9	3.02	4.55
Light duty trucks (gasoline)			
1968	66.5	7.1	4.9
1972	42.8	3.4	5.3
Heavy duty trucks (gasoline)			
1968	238.0	35.4	6.8
1972	118.0	13.6	12.5
Heavy duty trucks (diesel)	28.7	4.6	20.9

Source: Compilation of Air Pollutant Emission Factors, 2nd ed. U.S. EPA, 1976, Chapter 3.

Table 3. Federal exhaust emission standards for light duty gasoline engines

Source	Hydrocarbons (grams/mile) 1975-77	1978 and after	Carbon monoxide (grams/mile) 1975-77	1978 and after	Nitrogen oxides (grams/mile) 1975	1976	1978 and after
Light duty engine-gasoline (automobile)	1.5	0.4	15	3.40	3.1	2.0	0.4
Light duty trucks-gasoline (0-3,500 lbs.)	2.0	1.65	20	17.9	3.1	3.1	2.3

Source: Compilation of Air Pollution Emission Factors, 2nd ed. U.S. EPA, 1976, Chapter 3.

Table 4. Federal exhaust emission standards for heavy duty gasoline and diesel trucks

Source	Hydrocarbons (g/brake horsepower hr) 1975-77	1978 and after	Carbon monoxide (g/brake horsepower hr) 1975-78	1979 and after	Hydrocarbons plus Nitrogen oxides (g/brake horsepower hr) 1975-77	1978 and after
Heavy duty trucks-gasoline (greater than 8,500 lbs)	no current standard	1.5	40	25	16	10
Heavy duty trucks-diesel		1.5	40	25	16	10

Source: Compilation of Air Pollutant Emission Factors, 2nd ed. U.S. EPA, 1976, Chapter 3.

Table 5. Emissions factors for off-highway mobile sources

Source	Emissions Carbon monoxide	Hydrocarbons	Nitrogen oxides
Helicopters per takeoff landing cycle (pounds per engine)	5.7	0.52	0.57
Locomotives - diesel (pounds per 1,000 gallons)	130.0	94.00	370.00
Marine vessels (2,500 horsepower diesel in lbs/1,000 gal)			
slow	59.8	22.60	419.60
2/3	126.5	14.70	326.20
cruise	78.3	16.80	391.70
full	95.9	21.30	399.60

Source: Compilation of Air Pollutant Emission Factors, 2nd ed. U.S. EPA, 1976 Chapter 3.

Another point to insist upon is that predicted emissions from other proposed facilities in the modeling airshed be included in reviewing permit applications for solid waste facilities. It should be emphasized that the state can veto the location of an industrial or commercial facility that would violate ambient air quality standards.

There are several ways to examine the impact of solid waste vehicles on air quality to obtain a comparison of solid waste transit alternatives and a comparison of solid waste vehicular pollutant loadings with other similar sources. The following is a method for determining regional loads of air pollutants due to solid waste vehicles in transit to receiving stations.

The total daily and annual loads of air pollutants produced by solid waste vehicles in transit to receiving sites can be estimated once solid waste tonnage, the distance traveled, and the pollutant production rates of the carriers are known. Fuel consumption rates of solid waste barge towboats are shown in table 6.

Table 6. Towboat fuel consumption (1,000 gal/year)

Tons solid waste per day	Haul distance (miles) 5	10	20
200	40	80	160
400	42	84	168
600	44	88	176
800	48	96	192
1,000	51	102	204
2,000*	105	--	--

*A 5.5-mile one-way haul is assumed.

Source: Report on Solid Waste Transport by Barge for East Brunswick, NJ, Greeley and Hansen, 1981.

The basic calculation for each air pollutant of concern is done by municipality, and then the results for all municipalities are summed for the study area. The general equation for trucks, which uses the information in table 2, is:

$$\text{pollution production/day} = \frac{(\text{round trip distance (mi)})(\text{tons/day})\left(\frac{\text{pollution production}}{\text{mi}}\right)}{(\text{tons/truck})}$$

The equation for barge towboats is:

$$\text{pollution production/day} = \left(\frac{\text{daily fuel consumption}}{\text{boat}}\right)\left(\begin{matrix}\text{number of}\\ \text{boats}\end{matrix}\right)\left(\frac{\text{pollution production}}{\text{fuel consumption}}\right)$$

The load of air pollutants from solid waste trucks may be compared with that from other mobile sources over a unit distance. Solid waste truck traffic shifts as old disposal sites close down and new ones open in different locations. If facility centralization occurs over time, as happens with RRFs, air pollution impacts become more concentrated as solid waste truck traffic converges on the central facility. Air quality impacts due to solid waste trucks can be relatively severe in low traffic areas but not as noticeable in high traffic areas because of high background air pollution production from other mobile sources.

To the extent that truck traffic counts and traffic projections are available in the area of concern, a general picture of the relative severity of air pollution impacts due to solid waste vehicles can be obtained by comparing solid waste vehicle traffic with total truck and automobile traffic for current and future years. By applying the emission factors for mobile sources presented in table 2 to the traffic counts and estimation of solid waste vehicles traveling a unit distance of highway, it is possible to estimate the contribution of each vehicle type to the total air pollutant loadings over a unit distance in locations of concern.

Solid waste truck traffic through urban areas to a receiving facility should be avoided to minimize air pollution and noise impacts. A comparison of alternative solid waste truck routes to facility locations can be made by measuring the distance each route unavoidably travels in urban areas and multiplying it by the number of trucks using it in both directions each day.

Emission control. The Clean Air Act requires examination of the RRF's emission rates of certain gases, the area's existing air quality, and the area's predicted air quality when the facility is operational. Of the environmental problems usually associated with the operation of resource recovery facilities, air emissions are the most significant. Compliance with the Clean Air Act, and in particular with the 1977 amendments to it, must be considered as a first-order priority in planning for an RRF. It should be realized that obtaining a construction permit for any facility that would constitute a new major source of air pollution can be complex and time-consuming. Understanding the regulations can save delays and prevent wasted resources. Regulations under the act (Sec. 4, P.L. 91-604, 84 Stat. 1679) may influence the plant size and its process design and determine when construction can begin.

There are four major parts to the Clean Air Act. The National Ambient Air Quality Standards (NAAQS) establish acceptable and unacceptable levels of ambient air pollution. The Prevention of Significant Deterioration (PSD) regulations provide controls to prevent acceptably clean air from deteriorating beyond certain levels. The New Source Performance Standards (NSPS) establish emission limitations for new sources in specific industrial groups. The National Emission Standards for Hazardous Air Pollutants (NESHAP) set the maximum allowable emission rates of certain highly toxic pollutants.

Federal regulations establish minimally acceptable air quality and only function in the absence of a state air quality program: individual states may set equal or more stringent regulations than those of the USEPA. A state's program is known as the State Implementation Plan (SIP) and must be approved by the USEPA. SIPs are proposals to USEPA for state control of regulating air quality; they are the state's version of how to enforce the Clean Air Act. A SIP can be developed for all or any one of the four parts of the Act. NJDEP has developed a SIP and, at present, NJDEP's SIP replaces the

NAAQS portion of the Clean Air Act. NJDEP has also developed regulations to cover the PSD requirements and they are currently being reviewed by USEPA's district office in New York City. In addition, NJDEP is in the process of developing air quality permitting regulations for resource recovery facilities. Since the state's role in regulating air quality is expanding, any proposed resource recovery facility should obtain current information on NJDEP's and USEPA's regulatory authority for the various parts of the Clean Air Act. Proposals should be directed to both agencies.

National Ambient Air Quality Standards. The NAAQS set maximum ambient air concentrations for six major pollutants: carbon monoxide, nitrogen dioxide, sulfur dioxide, total suspended particulates (TSP), ozone, and lead. Areas in which a pollutant exceeds these standards are termed non-attainment areas. Non-attainment areas are classified as either primary or secondary, although the standards for primary and secondary non-attainment areas are the same for some pollutants. Primary standards are designed to protect the public's health, while secondary standards are designed to protect the public's welfare (e.g., to prevent damage or degradation to property, vegetation, wildlife, soils, visibility, etc.) Standards for sulfur dioxide and nitrogen dioxide are not contravened in New Jersey. Standards for the remaining four pollutants are presented in table 7.

The entire state of New Jersey is a primary non-attainment area for ozone. Portions of Middlesex, Union, Essex, and Hudson counties and the cities of Camden, Jersey City, and Bridgeton are secondary non-attainment areas for TSP. Sixteen business districts are confirmed primary non-attainment areas for carbon monoxide and 75 other areas are suspected non-attainment areas. Non-attainment areas for lead have not been identified, although monitoring for this pollutant will be conducted at 20 of the 100 TSP monitoring sites.

In a non-attainment area, no new major source of the pollutant can be constructed unless it incorporates pollution control technology that will provide the lowest achievable emission rate (LAER) for the pollutant and, if necessary, obtains pollution offsets from other sources in the area. The LAER is defined as the most stringent pollutant emission limitation determined by a state or achieved in practice by the class or category of source. The pollution offset measures must actually bring down the ambient concentration of the offending pollutant after the new source begins operation.

All new sources of pollutants must demonstrate that they do not contravene the ambient air quality standards. Any source violating the NAAQS for a given pollutant must execute a dispersion model, which factors in local winds, stack height, source strength, temperature, time of year, inversion strength, etc. and generate a prediction of the levels of concentration of that pollutant as a function of distance from source. Areas of compliance and noncompliance with ambient air quality standards are then identified.

Table 7. National and New Jersey ambient air quality standards exceeded in the state of New Jersey

Pollutant	Primary standards	Secondary standards
Carbon monoxide		
8-hr avg.	10 mg/m^3 (9 ppm)*	10 mg/m^3 (9 ppm)*
1-hr avg.	40 mg/m^3 (35 ppm)*	40 mg/m^3 (35 ppm)*
Total suspended particulates		
Annual geometric mean	75 ug/m^3	60 ug/m^3**
24-hr avg.	260 ug/m^3*	150 ug/m^3*
Photochemical oxidants (ozone)		
1-hr avg.	160 ug/m^3 (0.08 ppm)*	160 ug/m^3 (0.08 ppm)*
Lead		
Quarterly average	1.5 ug/m3	1.5 ug/m3

Source: NJDEP, Division of Environmental Quality, Bureau of Air Pollution Control, 1978; Reese, 1981.

Note: ppm = parts per million
ug/m^3 = micrograms per cubic meter
mg/m^3 = milligrams per cubic meter

* Not to be exceeded more than once per year
** Guideline for achieving the 24-hour secondary standard

Prevention of Significant Deterioration. The PSD regulations (40 CFR 52.21) are designed to prevent acceptably clean air from deteriorating, while maintaining a margin for future industrial growth. PSD reviews apply only to those areas that are NAAQS attainment areas. Major sources that will emit a pollutant in a non-attainment area for that pollutant will not require a PSD review. Instead, the emission of the pollutant will be reviewed under NJDEP's SIP. Because the portion of NJDEP's SIP that pertains to PSD regulations is being reviewed for approval by the USEPA district office in New York, the following discussion pertains to federal PSD regulations; however, in the future, PSD reviews may differ according to approval of the portions of NJDEP's SIP that implement federal PSD regulations.

PSD regulations define major pollution sources that must be reviewed and they establish the steps such a source must follow to obtain a construction permit. PSD regulations are concerned with 15 regulated pollutants--six criteria pollutants, which correspond to NAAQS pollutants, and nine noncriteria pollutants (see table 8). In addition, they set forth the increments by which air quality may deteriorate for sulfur dioxide and TSP and they provide for the determination of air quality baselines.

Table 8. Pollutants covered by Prevention of Significant Deterioration regulations

Criteria pollutants	Noncriteria pollutants
Carbon monoxide	Asbestos
Nitrogen oxides	Beryllium
Sulfur dioxide	Mercury
Particulate matter	Vinyl chloride
Ozone	Fluorides
Lead	Sulfuric acid mist
	Hydrogen sulfide
	Total reduced sulfur (including hydrogen sulfide)
	Reduced sulfur compounds (including hydrogen sulfide)

Source: USEPA, 1980.

A new major stationary source is subject to PSD review if (1) it is one of 28 listed industrial sources and emits or has the potential to emit 100 short tons per year (STPY) of a regulated pollutant or (2) it is an unlisted stationary source that emits or has the potential to emit 250 STPY of a regulated pollutant. Included among the 28 industrial sources are municipal incinerators capable of charging more than 250 tons of refuse per day.

As the regulations now read (40 CFR 52.21 (b) (5) and (6)), a "source" is defined as any pollution-emitting unit or group of units under common ownership and located on contiguous or adjacent properties. Its "potential to emit" is its maximum capacity to emit a pollutant under its physical or operational design. Included within the definition of design is any federally enforceable limitation on the source's physical or operational design and air pollution equipment. Secondary emissions, e.g., emissions that are associated with the operation of the source but do not come from the source itself (such as associated vehicular traffic), are not considered part of the source's emissions.

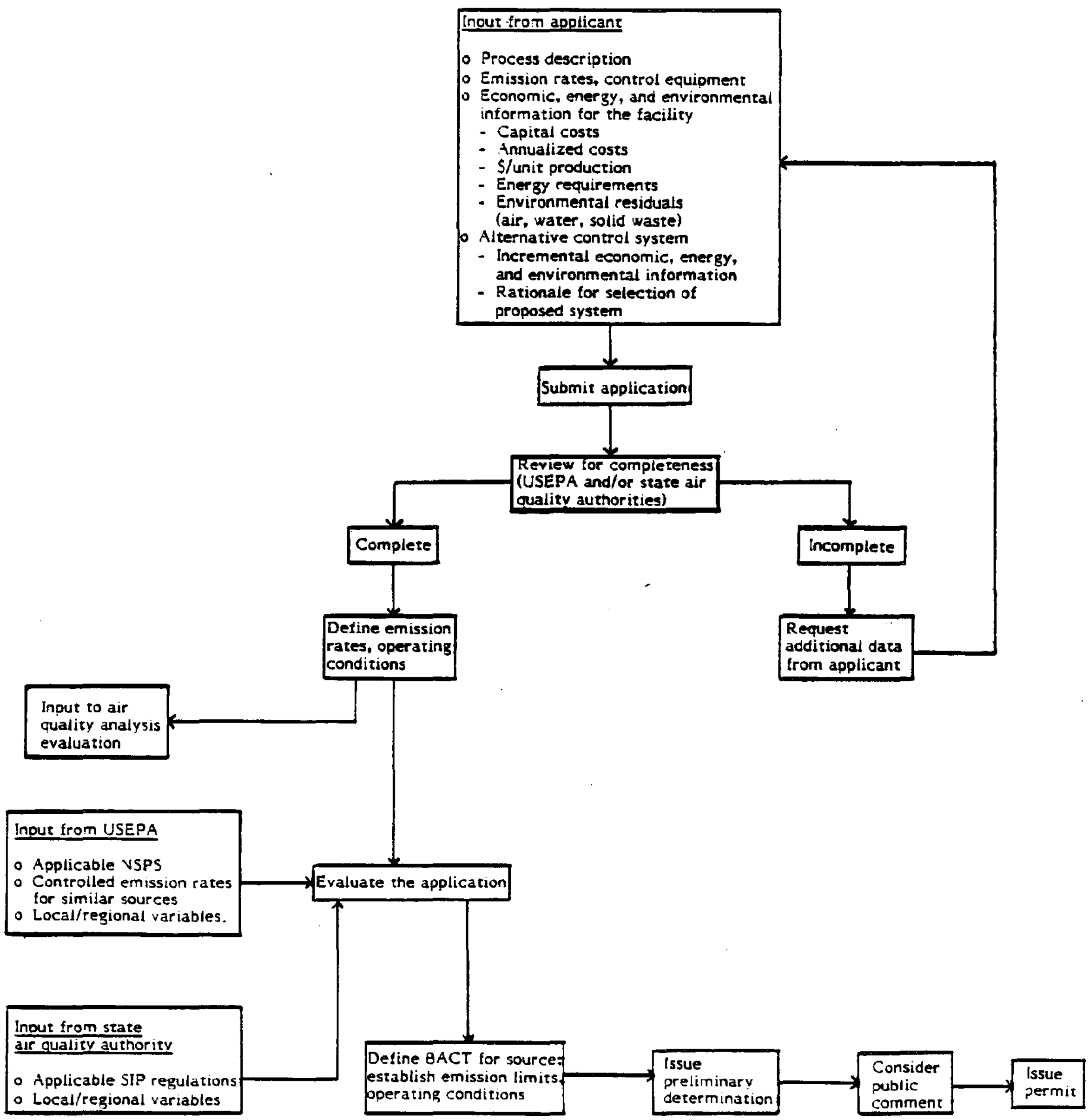
The PSD review requires analysis for each pollutant that exceeds the 100-STPY limit for one of the identified 28 industrial sources or the 250-STPY limit for other new major sources. This analysis includes (1) best available control technology (BACT) analysis, (2) air quality impact analysis, and (3) additional impact analysis.

BACT analysis determines the control strategy to be required for a source undergoing the PSD review process; therefore, it also ultimately determines the emissions from a source. Results of the BACT analysis may reveal that application of efficient emission controls exempts the proposed source from PSD review altogether. The review process for BACT is outlined in figure 10. Once emission control strategies are identified, economic, energy, and environmental impact analyses for each strategy must be completed. The results of these analyses are used in determining the BACT for an RRF.

BACT is determined by the reviewing authority on a case-by-case basis, and it must be installed to reduce emissions for each significant pollutant identified by the reviewing authority. Today, for RRFs, the best available control technology standard has only been applied to the reduction of TSP emissions. However, BACT is required for any pollutant emitted in significant amounts. Determination of what actually constitutes the BACT for a pollutant such as sulfur dioxide might well change the rules from no emission control at all to a requirement that scrubbing units be placed on the stacks. A BACT for nitrogen oxides emissions might take the form of controls on combustion temperatures. Monitoring requirements for operating facilities might change from periodic tests to continuous monitoring of stack emissions.

Exactly what determines BACT is probably the most hotly debated issue in the American resource recovery industry, especially in California and Oregon, where major projects are being proposed. American industry representatives contend that advanced-design electrostatic precipitators (ESPs) are the best approach. ESPs,

Figure 10. Flow diagram for the determination of best available control technology



Source: Quantum Associates.

however, can only remove particulates; they leave trace gases (e.g., nitrogen oxides, sulfur dioxide, and hydrofluorides) mostly untouched. European sources, especially those in Germany, are prepared to offer combinations of scrubbers with ESPs to remove trace gases in addition to particulates. In addition, German sources are offering baghouse filters in lieu of ESPs for improved particulate removal. The designation of West Germany's superior emission control technology as a BACT and its application to RRFs is a crucial decision that must be made by the PSD reviewing authority. Such a determination would significantly alter the RRF's design and capital costs.

A BACT analysis and its results provide the majority of the input data for the other two required PSD analyses: the air quality analysis and the additional impacts analysis. The air quality analysis is used to demonstrate that neither NAAQS nor an allowable PSD increment will be violated as a result of the emissions from an RRF. It must be conducted for each regulated pollutant subject to PSD review that is expected to be emitted from a resource recovery facility or whose emission is expected to significantly increase in conjunction with the RRF's operation. The air quality analysis will require continuous ambient air quality monitoring data on the proposed site for the regulated pollutants which the plant would emit in "significant" amounts. Continuous monitoring must occur for at least a year before the application is reviewed, although this period may be reduced to not less than four months by the EPA's district administrator. Monitoring is often required for more than a year. The monitoring establishes a baseline against which any changes in air quality caused by the proposed RRF can be modelled. The sponsors of the RRF must demonstrate, through the use of the baseline monitoring and air quality analysis, which may include dispersion modeling, that pollutant emissions will not adversely affect either non-attainment areas established by NAAQS or federally designated class 1 air quality areas.

The last part of the PSD review is an additional impact analysis for each pollutant subject to review. This analysis determines the air pollution impacts on soils, vegetation, and visibility and includes air quality impacts due to associated commercial, residential, and industrial growth and secondary emissions.

Once a complete application has been submitted, the PSD reviewing authority has up to one year to make a determination on whether the construction should be approved, conditionally approved, or disapproved. During this time, the public must be notified of the proposed construction, a hearing must be held, and all written comments must be considered. Finally, after the PSD permit is granted, construction of the new source must commence within 18 months and proceed in a continuous manner. Once the source is in operation, emissions must be periodically monitored to ensure that they have remained within specified limits.

New Source Performance Standards. NSPS (40 CFR 60.40-45) set emission limits on particular pollutants of specific industrial categories. Most RRFs are covered as incinerators. The federal regulations specify that the acceptable maximum TSP emission rate of each incinerator unit capable of charging more than 50 tons of municipal-type waste in a 24-hour day is 0.08 grains per dry standard cubic foot (DSCF). This standard is being revised, and RRFs will be covered under the new standard of performance that will apply to waste-fired boilers.

RRFs may also be covered by NSPS under the standards of performance for fossil-fuel steam generators. If the RRF has the capability to burn more than 250 million BTU per hour of fossil fuel or fossil fuel and wood residues, standards must be met for particulates, sulfur dioxide, and nitrogen oxides. Gases containing particulates in excess of 0.10 lbs. per million BTU cannot be discharged from the facility. Standards for sulfur dioxide and nitrogen oxides depend on the type of fossil fuel used (gaseous, liquid, or solid) and on whether a combination of fossil fuels is being burned. When lignite or solid fossil fuel containing 25 percent or more of coal refuse by weight is burned in combination with another fossil fuel or wood residue, the standards for nitrogen oxides do not apply.

National Emission Standards for Hazardous Air Pollutants. NESHAP regulates emissions of highly toxic chemicals. Pollutants currently listed as hazardous are asbestos, beryllium, mercury, vinyl chloride, benzene, arsenic, and radionuclides. Specific emission limits applicable to incinerators exist only for beryllium. Sewage sludge incineration is covered under standards for mercury. The emission limit for beryllium is 10 grams per 24-hour period, and for mercury it is 3,200 grams per 24-hour period. Additions to this list may have more impact on RRFs than chemicals currently listed.

NJDEP Air Quality Permitting Regulations. NJDEP is in the process of developing air quality permitting regulations that will require the application of state-of-the-art pollution control technology in resource recovery facilities. Standards that are determined for this technology are likely to resemble standards currently applied to municipal solid waste incinerators.

NJDEP's current state-of-the-art guidelines for municipal incinerators require a minimum incinerator temperature of 1,800°F and a residence time of one second. TSP emissions are restricted to .03 grains per DSCF, which is more stringent than the federal NSPS of .08 grains per DSCF. Nitrogen oxides emission levels are restricted to 3 lbs. per ton of charged wastes. Halogenated acids emissions are limited to 50 ppm or 90 percent control, whichever is more restrictive. NJDEP permitting regulations for municipal incinerators state that heavy metal and hydrocarbon emissions must also be reviewed on a case-by-case basis.

General Impacts. Because of the many variables involved, the specific design and locational characteristics of a proposed RRF must be reviewed in-depth before impacts of can be adequately described. However, a general discussion of the impacts is possible, based on common or probable characteristics.

Unburned hydrocarbons are emitted to the atmosphere under conditions of incomplete mixing and poor combustion of the solid waste. Emissions from typical U.S. municipal incinerators range from .3-2.7 lbs. of hydrocarbons per ton of refuse. However, most of these incinerators no longer represent state-of-the-art technology. Studies in West Germany indicate that an RRF with a modern waterwall system emits unburned hydrocarbons in the range of .075-.3 lbs. per ton of refuse.

The importance of hydrocarbon emissions to air quality is due to their reacting with nitrogen dioxide in the presence of sunlight to produce photochemical oxidants. (Methane is not photochemically reactive; therefore, the emitted hydrocarbons of concern are non-methane hydrocarbons.) Ozone is the principal oxidant formed, which has detrimental effects on humans, vegetation, and some organic compounds.

Hydrocarbons are released to the atmosphere whenever petroleum products are produced, handled, or burned. Table 9 presents a nationwide estimate of sources of hydrocarbons.

Table 9. Hydrocarbon sources in the United States (percentage of total emissions)

Transportation	52%
Organic solvent evaporation	27%
Industrial processes	14%
Solid waste disposal	5%
Fuel combustion in stationary sources	2%

Source: Quantum Associates.

Many areas, particularly urban areas, are non-attainment areas for hydrocarbon and ozone emissions. At present, there are no emission standards for hydrocarbons released from incinerators, although all new sources of pollutants must demonstrate that they do not contravene ambient air quality standards.

The incineration of plastics will result in the release of hydrochloric (HCl) and hydrofluoric (HF) acids. At present, the USEPA is reviewing what course of action should be pursued in regard to these emissions, particularly the emission of HCl. In addition, NJDEP is reviewing state-of-the-art technology for the removal of HCl.

The emission of total suspended particulates (TSP) will also occur. Emission levels depend on the processing method used. Federal standards require that TSP not exceed .03 grains per DSCF.

Finally, sulfur dioxides and nitrogen oxides will also be released, although solid wastes are relatively low in sulfur and nitrogen content. Table 10 presents examples of nitrogen oxides emission rates for various types of combustion.

Table 10. Nitrogen oxides emission rates for various types of combustion (lbs./MBTU)

Coal (utility)	.80
Automobile	.75
Oil (utility)	.70
Oil (industry)	.45
Gas (utility)	.37
Mass burning plant	.25

Source: Quantum Associates.

Equipment, truck, barge, or towboat maintenance. Volatile solvents used for equipment and vehicle maintenance are potential but minor sources of hydrocarbons.

Microclimate

The microclimate comprises the climatic conditions at or near the ground in specific locations. The microclimate factors of concern are fogging and freezing, which may occur when large amounts of water vapor are introduced into the air from a single source under certain climatic conditions.

Activities That Impact Microclimate

Certain activities related to facility operation may affect the microclimate. In selecting an acceptable waste heat rejection system for an industrial facility, a choice is made between natural bodies of water and atmospheric evaporative cooling as alternative heat sinks. Process and site factors have to be taken into consideration in making this choice.

Among the drawbacks of the atmospheric approach is the potential for fogging, which could affect visibility on nearby roads. Visible plumes are produced when the airstream leaving the cooling tower combines with the atmosphere to form mixtures that precipitate fog droplets. Plume formation can be reduced by lowering the relative humidity or moisture content of the cooling tower emission. A determination of the severity of the cooling tower plume problem requires knowledge of the characteristics of the tower emissions, mass flow, velocity, wet and dry bulb temperatures, and moisture content. The atmosphere, therefore, must also be characterized according to temperature, relative humidity, barometric pressure, and wind velocity, and the rate of change of these characteristics over time and space must be known.

Once these data are available, the travel and dispersion of the plume can be described by application of meteorologic models and related spatially to fog-sensitive land uses, such as highways, located near the cooling towers. In addition, any possible interactions between the plume and stack emissions should be identified by the operator.

Mitigative Actions

Handling of volatile organic substances from construction activities. The municipality can amend its building code to require the site developer to:

- o list approximate volumes of volatile organic substances (VOS) to be used during construction
- o designate safe storage locations
- o specify how spills will be cleaned up by means of minor spill control plan
- o describe how VOS will be stored and moved on site
- o dispose of containers in a way that will not result in the release of residual contents to air

Such an ordinance should also require the local building officer or fire marshall to include an inspection of VOS storage and handling during site visits.

Control of emissions from trucks, barges, towboats, and construction equipment. The municipality can, through appropriate ordinance, require local police to be trained in on-the-road (or on-site) enforcement of emission standards set by DEP and to perform periodic inspection of vehicles for proper inspection stickers.

Reduction of emissions associated with a solid waste transfer facility. The following steps may help reduce the impact of emissions.

- o Avoid sensitive receptors in transfer station site selection.
- o Provide alternative approaches to site.
- o Limit overall capacity of transfer station.
- o Improve circulation on approaches to site.
- o Establish truck queueing system that permits motor shutoff while waiting to unload.

RRF emission control techniques. West Germany has the most stringent emission standards in the world and its technology in controlling emissions from mass burning facilities appears to be the most advanced. At present, common emission control technology in the United States is the use of electrostatic precipitators; however, officials in the United States are reviewing West Germany's technology in terms of state-of-the-art technology designation.

West German technology includes the use of wet and dry scrubbers and baghouse filters to achieve low pollutant emission rates. For example, a West German system with dry scrubbers and baghouse filters has achieved a 66 percent reduction in total emissions at a capital cost of $2.5 million. A refuse incinerator plant in Kiel, West Germany, with a wet scrubbing system optimized for acid gas removal averaged 98 percent HCl removal and 96 percent HF removal. Another plant with a dual stage wet scrubbing system, one for acidic and one for basic removal, achieved removal rates of 99.7 percent for HCl, 97.4 percent for HF and 97.0 percent for sulfur dioxide. However, wet scrubbing systems present wastewater removal problems.

As noted earlier, in the United States electrostatic precipitators are standard emission control mechanisms.

Other mitigative measures concern the operation of the facility. Operators should be trained to ensure as complete combustion as possible within the facility's design constraints. Monitoring controls can be installed to evaluate changes in operating parameters. Individual chimney flues will also help to ensure efficient combustion.

Finally, site selection for the facility should consider regional differences in air quality, microclimate, dispersion characteristics, and surrounding land uses.

Earth Resources

Soils

Soils and landforms are earth resources referred to in an environmental assessment. Soils are the upper and biochemically weathered portion of the regolith, and they are composed of air, water, minerals, and organic matter. The weathering may occur to the underlying rock or to deposited mineral matter transported by the actions of water, glaciers, or wind. The weathering process is dependent on climatic conditions, slope, and vegetation, and it synthesizes the soils into horizontal profiles. The physical characteristics of soils include structure, texture, density, moisture content, grain size, permeability, depth to bedrock, and depth to water table.

Erosion refers to soil loss by the wearing-away actions of running water, wind, ice, or other geological agents. Although varying degrees of erosion occur naturally, in general, the result of man's activities on the land is to accelerate the erosion process, usually through the removal of natural vegetative cover. The portion of the soil that is lost first is the top surface--the most productive portion of the soil.

The quality and productivity of soils for vegetation are dependent upon the soil's physical and chemical characteristics. Productivity is usually expressed as the capacity of a soil to produce a specified plant, usually a crop, under a certain management system. Depletion of soil nutrients, contamination, and disturbance of the soil's physical structure can decrease a soil's productivity.

Drainage, which promotes conditions favorable for plant growth, is dependent upon the type of soil and the water table depth. In terms of plant growth, good drainage allows roots to extend deeper and facilitates the warming of the soil in spring. Drainage is also important in determining a soil's ability to support structures.

All of the impacts on soils of an RRF or transfer stations will be a result of preoperation activities, particularly clearing, earthwork, and construction. RRF and transfer station site preparation activities will have the same effects, although the specific sites involved will, of course, differ. Since the area affected by the RRF site preparation activities will be larger than the area affected by the transfer site activities, the effects of the former facility will be greater than those of the latter. Similarly, the preoperation activities that would affect soils during road improvement activities are the same as those used during site preparation but probably occur over a smaller and less significant area (i.e., a strip along existing roads).

The New Jersey Soil Erosion and Sediment Control Act (N.J.S.A. 4:24-1 et. seq.) requires certification for projects that disturb more than 5,000 square feet. Information and applications can be obtained from the local soil conservation district offices.

The New Jersey Department of Transportation (NJDOT) requires permits for any road construction tie-ins to NJDOT roads that will affect the drainage of NJDOT rights-of-way. Permit applications should be submitted to NJDOT district offices.

The site preparation and construction activities described in the following section on direct impacts will occur on a site-specific basis, and these effects can be viewed together in the preparation of an environmental assessment. A site-specific assessment must review each activity as it applies specifically to the site by reviewing the extent of the activity, the equipment and methods to be used, the time of year, and the condition of the soils. The construction contractor will be able to provide information on the extent of the activities and the equipment and methods to be used.

The most useful data on soils can be obtained from the Soil Conservation Service's (SCS) office in Trenton, most notably its Soil Survey publications. Soil surveys are prepared for each county, and detailed maps delineate the boundaries of each soil type. The surveys also provide information on the physical and chemical characteristics of the soil types and analyze their ability to support improvements and crops. These data, along with other soil information from either the SCS or local planning agencies and the information on site-specific activities (as discussed above) and their impacts (as discussed in the following section), will be the basis for an environmental assessment of the impacts of site and construction activities on soils.

Activities That Impact Soils

Access road construction. In some cases it may be necessary to construct access roads from public streets to either the transfer station or the RRF site. The activities involved in the construction of an access road (equipment operation, vegetation removal, and grading) will have impacts on soils similar to those that will occur in the site's preparation. The need to construct an access road does mean, however, that a larger area will be affected.

General construction: equipment operation. Construction equipment (transport trucks, bulldozer, backhoes, etc.) will be used during preoperation activities. The use of these heavy vehicles will cause surface disturbance to the soil and compaction. There is also the possibility of leaks or spills of lubricants or fuels. Compaction changes the soil's physical characteristics by increasing its density and reducing pore spaces. This changes drainage patterns by reducing water infiltration rates, restricts root penetration, and inhibits gas exchange. Compaction may also increase erosion because surface runoff is increased. Surface disturbance from vehicle movement, particularly when the surface soil is saturated, produces ruts, which change the soil's physical condition and encourage erosion. Spills and leaks change the chemical content of the soil and lower its productivity, although usually this occurs over a very small area.

Clearing: vegetation removal and disposal. Most of the vegetation to be removed will probably be in the transfer station and RRF sites. It may also be necessary to remove some vegetation adjacent to roads during road improvement for access by construction equipment.

The removal of vegetation will tend to increase erosion, change the physical characteristics of the soil, and alter its potential for productivity. Vegetation holds the soil in place, protects it from the force of raindrops, slows surface runoff, and increases percolation. All these actions decrease erosion. In addition, loose particulates will be exposed and susceptible to wind erosion. The roots of vegetation also prevent compaction. Vegetation is important to the soil's productivity because it is essential to the nutrient cycle. It affects the soil's moisture content by decreasing evaporation from its shade and increasing soil moisture loss, particularly when the soil moisture content is high, through transpiration. Vegetation also modifies the extremes of soil temperature.

Earthwork: surface grading. Grading will increase erosion over the short term, although once the soil is stabilized and revegetated, erosion may be less than it was originally.

Grading also severely alters the soil by redistributing it. The soil profile is changed, moisture is lost, and the density of the soil is changed. In short, most of the soil's physical characteristics will be changed.

The soil's productivity will also be altered, but the extent of change depends primarily on the resultant physical characteristics of the soil. Some nutrient loss should be expected unless nutrients are brought to the surface of highly leached soils.

Earthwork: rock fracturing. Rock fracturing, if it occurs at all, will take place during the site preparation for the transfer station and RRF. Its expected impact would be an increase in drainage.

Earthwork: cut and cover. The cut and cover method involves digging trenches for cables, sewer lines, water lines, etc., laying the necessary material in the trench, and then covering it over with soil. The area affected is rather small. The mixing of the soil in the specific area alters its physical characteristics rather as grading does. Erosion and drainage may be encouraged slightly, particularly if the trench follows a slope.

Earthwork: backfill and restoration. Backfill will affect the physical characteristics of soil in the same manner as cut and cover activities. Erosion and drainage may be encouraged during the initial stages of this activity, but once restoration takes place, particularly if the area is revegetated, erosion and drainage should be at normal levels.

Disposal of dredge material. If dredge material is disposed of on land, it will significantly alter the soil by adding a layer of dense material on top of it. This will add organic matter, nutrients, and water to the soil. The effects of disposal will be similar to those of vegetation removal, although these will probably be temporary, since revegetation should occur quickly. However, the effects of the dredge material are difficult to identify without knowing its chemical content, which will have a selective influence on vegetation growth.

Indirect Impacts Associated with Soils

Soil erosion increases turbidity, siltation, non-point source pollution volumes, dunes and nutrient levels of streams adjacent to the site unless a buffer is present. Increased nutrient levels will increase biological oxygen demand (BOD). Increased sediment loads also affect the stream's morphology.

Particulates will be added to the air if wind erosion occurs due to vegetation removal and soil disturbance.

Any changes in the soil's productivity will change its ability to support vegetation, and changes in vegetation will, in turn, affect wildlife. Some soil organisms will be directly disturbed. The lack of vegetation and increased water turbidity alter the visual quality and landscape character of an area.

Mitigative Efforts To Protect Soils

The following actions may be employed to mitigate the impact of the activities noted above on soils:

- Grade and contour access roads and, if possible, do not build on erodible soils.
- Maintain vegetated buffers between the site and adjacent streams.
- Vegetation removal should be kept to a minimum and re-vegetation should occur as soon as possible.
- Erosion control practices should be employed. They include terracing and contouring, use of ground cover (straw, fabric, wood chips, etc.), and use of berms and sodden channels.
- Schedule work during periods when high rainfall is least likely. Also avoid work during the spring thaw.
- Avoid unnecessary off-road vehicular travel.

Land Form

The land form factors relevant to the construction and operation of an RRF or transfer station are surface runoff, slope stability, subsidence, and landscape character. Surface runoff is the overland flow of surface water from precipitation before it reaches a body of water or percolates to the groundwater. It is dependent on the drainage capabilities of the soil, vegetation, and topography. Surface runoff is the most significant means by which erosion occurs. Together, drainage and surface runoff are important factors that must be considered in determining necessary site improvements.

The stability of a slope is dependent on the slope's angle, the soil type, ground cover, groundwater conditions, climate, and the susceptibility of the bedrock to fracturing. Areas where slope stability is a problem can often be determined by inspection, and these areas should be avoided.

Subsidence is the downward compression of land with no or little horizontal displacement. Soils containing large portions of organic matter, clay, and silt are susceptible to subsidence when structures are built on them. In general, subsidence is a problem in wetlands or other areas where organic soils are present. Ideally such soils should be avoided; however, if it is necessary to build on such soils, specific foundation improvement methods must be employed.

Landscape character refers to the visual image of an area due to changes in relief, land forms, vegetation, and the relationship among them. A change in any of these elements will change the view, and significant changes will alter the character of the landscape. This effect, of course, cannot be measured as easily as can others. What constitutes a landscape with character or importance is purely a subjective judgment. At the least, however, land forms that are recognized by the local population as being natural landmarks can be considered to be important.

These four factors can best be determined by a visit to the site by a land planner or landscape architect. A visit and review of a contour map of the site will reveal existing areas where surface runoff is likely to occur. This information should be compared to the site plan proposed by the developer of the RRF. The contour map along with a site inspection will reveal slopes where stability will be a potential problem. Soil surveys and a site inspection will reveal where soils susceptible to subsidence occur. A visit along with photographs, if possible taken when the maximum and minimum amounts of foliage are present, will indicate the character of the site. Sketches and possibly even a model of the site will show how the site's character will change.

The contractor should be contacted to determine the extent to which each activity will be employed and the equipment to be used. The site plan and architectural drawings will indicate the placement and relationship of the improvements. This information should be compared with the information from discussions on direct impacts to assess the impacts on land forms.

Activities That Impact Land Form

Most of the impacts on land form will occur during pre-operation activities, particularly clearing, earthwork, and construction. The only impacts that should occur during the operation phase will be the result of the existence of structural improvements and the disposal of material dredged during maintenance or while maintaining the barge channels. The activities involved in the preparation of the RRF and transfer site and in road improvements are similar, although the size of the affected area will differ. Therefore, the discussion will focus on the site preparation and road improvement activities. Land form impacts are closely associated with and partly depend upon impacts to soils.

Access roads. The clearing and grading necessary to construct an access road will increase surface runoff. The road may promote erosion gullies that will channel surface water. The road itself and the contour changes necessary for its construction will change the land form.

General construction: equipment operation. Compaction and ruts, which will be more pronounced if the soil is wet, will result from equipment operation. Both of these surface changes will increase surface runoff, although the impacts will be short term.

Clearing: vegetation removal and disposal. The exposure of the soil through vegetation removal can be expected to increase surface runoff. This is because (1) vegetation promotes water infiltration and protects the soil from the force of raindrops, (2) the soil will become more compact, and (3) erosion gullies will promote runoff. Also, removal of vegetation will change the character of the landscape.

Earthwork: surface grading. By exposing loose soil and increasing erosion for a short period, grading may also temporarily increase surface runoff. However, if the resulting slope is less than it was formerly, runoff may decrease, particularly after the area is revegetated. For the same reason, slopes that were formerly potentially unstable may become more stable if the slope's angle is less. Since the contour of the land will be changed, the character of the landscape will be altered. How much it is altered will depend on how extensive the grading operations are.

Earthwork: rock fracturing. Rock fracturing will facilitate the creation of trenches and gullies that will increase surface runoff. This impact is short term and will last until the area is covered. Since fractured rocks will increase drainage, the long-term effect may be a slight decrease in surface runoff.

Blasting and drilling of rocks may increase the instability of surrounding slopes. If the rocks were exposed, their fracturing and removal will alter the character of the landscape.

Earthwork: cut and cover. The loose soil and erosion associated with cut and cover activities will tend to slightly increase surface runoff for the short period until the area is revegetated.

Earthwork: backfill and restoration. As is the case with cut and cover activities, increased erosion following backfill should increase surface runoff for a short period.

Disposal of dredge material. If dredge material is disposed of on land, erosion gullies may form and increase surface runoff. In addition, the dredge material will not absorb rainfall as quickly as mineral soils will, and surface runoff on dredge material will be greater.

The weight of dredge material will cause subsidence of the soils below. In addition, the landscape character will be affected. Overall, the area will be higher in elevation, and the color, texture, and contour of the land will be changed. The vegetation that will eventually cover the area will be different from the preconstruction vegetation because of differences in the chemical and physical characteristics of the soil.

Existence of improvements. The physical presence of a transfer station or RRF will alter the character of the landscape. A discussion of the visual perception of the structures is included in the section on public comfort.

Indirect Impacts Associated with Land Form

Surface runoff will increase turbidity, siltation, non-point source volumes, nutrient levels, and BOD in streams adjacent to the site. Increased sediment will also affect stream morphology. The species composition and community dynamics of aquatic plants and animals will also be adversely affected.

Changes in the landscape character will affect the visual quality of the area.

Mitigative Actions

Since practices that reduce erosion will also reduce surface runoff, most of these techniques are also listed in the section on soils.

- Remove as little vegetation as practicable and re-vegetate as soon as possible.
- Maintain buffers between the site and adjacent streams.

- Employ erosion control techniques to reduce surface runoff.
- Grade and contour access roads.
- Terrace, contour, and use ground cover on the land to avoid erosion.
- Avoid unnecessary use of off-road vehicles.
- Schedule work during periods when high rainfall is least likely.
- Avoid construction on steep slopes and erodible soils.
- Avoid destroying natural landmarks and other visually prominent landscape features.

Water Resources

Surface Water

The aquatic environment provided by surface waters is dynamic, and compared to other natural systems, it can assimilate many episodic changes relatively well. Because of the continual renewal of their water source, the mixing of water, and biological activity, streams can return to their former state relatively quickly after an activity has affected them. Non-flowing surface waters--lakes and wetlands--are also quite durable, although not as durable as streams. A continuous disturbance (e.g., a continuous industrial waste source) is more disruptive than an episodic one. Pollutants are quickly carried downstream, where they may accumulate in wetlands or estuaries, thereby causing greater damage than was done at the point of introduction.

The first three factors listed under surface water in the environmental component chart (fig. 6) describe its physical characteristics; they include quantity and distribution, stream flow, and stream morphology. The quantity and distribution of surface water refer to the amount of water and where it is distributed (i.e., streams, lakes, etc.). Major changes in the quantity of surface water are a result of climatic conditions and the activities of man. Stream flow refers to the physical characteristics of stream water: its speed, water level, turbulence, etc. Obviously many characteristics of stream flow are dependent upon the quantity and distribution of surface water. The quantity and distribution of surface water and stream flow both help determine stream morphology. Other factors that affect the development of a stream's form are the geologic features and soils through which the stream flows, elevation changes, and the load of suspended solids. A stream attempts to equalize its energy throughout its length and to follow the path of least resistance. This results in a very gradual development toward the meandering, snake-like morphology of old, well-developed rivers. Any construction that attempts to arrest this development will be met with continual resistance from the energy of flowing water and will result in downstream changes in stream morphology.

The other characteristics of surface water listed in the environmental component chart are related to water quality. Turbidity and sedimentation are indications of the concentration of suspended solids in the water and the rate at which they are deposited. In general, the suspended solids are sediments that have reached the stream by runoff, soil erosion, construction activities, or filling and reclaiming wetlands or ponds. Chemical quality refers to changes in the natural chemical composition of a body of water. The ambient chemical compositions of surface waters differ, and, in fact, biological activity may be limited because of the natural leaching of minerals and compounds that form humic acid. However, the introduction of foreign liquids and suspended solids will change the chemical composition of a stream and will most likely lower its chemical quality. Biological oxygen demand (BOD) is the oxygen necessary to met the metabolic needs of aerobic microorganisms. Since the number of microorganisms increases as the amount of organic matter (often sewage) increases, BOD is an indirect measure of the concentration of organic matter in surface waters. The concentration of oxygen may be reduced to levels so low that the biological quality and the health of organisms may be impaired. In severe cases, organisms may suffocate because an abundance of microorganisms has depleted the oxygen. Surface water data can be obtained from regional 208 plans, the US Geological Survey's Water Resources Data for New Jersey, local planning offices, and the NJ Department of Environmental Protection.

Groundwater

Groundwater is the water in the saturated zone of underlying material below the water table, which is the upper limit of saturation. The quantity and distribution of groundwater can be altered by pumping or by restricting percolation and increasing surface runoff. The chemical quality of groundwater is impaired when foreign chemicals are leached through the ground and introduced into the groundwater. This impact of leached pollutants is particularly significant in areas that recharge aquifers used for domestic purposes. Groundwater data are based on well records obtainable from the USGS's office in Trenton and local plans.

Activities That Impact Surface Water and Groundwater

Access road construction. The construction of access roads can have significant impacts upon surface water quality as a result of erosion of the soil exposed during clearing and excavation of the roadbed. Improper location of the road or design treatment of drainage relationships can permanently alter surface drainage patterns and groundwater recharge. The concentration of runoff from impervious road surfaces can lead to stream bank erosion, modification of receiving stream cross-section because of augmented storm flows, and reduction of normal groundwater recharge for stream base flow and aquifer recharge.

General construction: equipment operation. The operation of construction equipment destroys natural cover, leading to soil erosion and subsequent stream sedimentation. Such equipment also compacts soil, leading to increased runoff and denial of recharge to groundwater for stream flow and aquifers. Such alteration of the stream hydrograph leads to changes in stream morphology through stream bank erosion.

General construction: material delivery and handling. Some construction materials are soluble in water and can be leached into the groundwater or are finely divided enough to be suspended by storm water and carried to surface water.

General construction: labor force. During construction, the labor force must be provided with adequate toilet facilities to avoid contamination of surface water and groundwater.

General construction: disposal of waste. On-site burial of construction wastes such as empty containers of liquid construction materials can lead to high local concentrations of dangerous synthetic substances in groundwater and nearby streams via infiltration. Such burial of construction wastes is prohibited by state law (N.J.A.C. 7.26).

Clearing: structural demolition. Abandoned structures slated for demolition are often used for clandestine disposal or storage of hazardous liquid waste. Demolition could rupture containers, leading to contamination of groundwater and surface water.

Clearing: vegetation removal and disposal. Removal of vegetation exposes upper soil layers to erosion, resulting in increased sediment loads to streams. Storage of dead vegetation may lead to unwanted nutrient enrichment of ground and surface waters by the leaching action of rainwater.

Control of erosion from this activity is the purpose of the soil erosion and sedimentation control plan that must be certified for approval of construction.

Dredging and filling: initial and maintenance. Dredging and filling are likely to be necessary during dock construction and connection to main channel at barge transfer stations and subsequently for maintenance of channel depth. Dredging and disposal of dredged material can have significant effects on water quality by releasing suspended particles and on currents and salinity patterns in estuaries by changing bottom configurations. There is also the possibility of sediment uptake of pollutants on river bottoms. If this bottom material is subsequently dredged, it may release these pollutants to the groundwater. The Army Corps of Engineers is authorized to regulate dredging and filling activities.

Physical presence of structures. All structures and roads present impervious surfaces to stormwater, which is usually directed via storm sewers to nearby streams. The increased stream flow created by denying infiltration causes erosion of stream banks, and interstorm stream flow decreases because less water is stored in the soils.

Equipment maintenance. If disposed of improperly, spent oil from machinery crankcases can threaten groundwater and surface water.

Truck traffic and hauling, river traffic. Emissions from truck traffic contain oxides of sulfur and nitrogen. When solubilized and flushed from the atmosphere by precipitation, they form acids in water solution that adversely affect aquifer organisms by lowering the pH of the water. Spills from barge may also adversely affect the aquatic environment. The degree and manner of the degradation depend on the type and amount of spillage.

Mitigative Actions

The following actions can be taken to protect water resources during the construction and operation of an RRF and related facilities:

- Delay runoff from roofs or encourage infiltration of runoff at source, through design of structures, in order to control runoff volumes and peaks.
- Increase overland flow time to maintain sufficient infiltration to shallow groundwater to ensure no retardation in the dry-weather flow of streams.
- Construct flood control devices that delay discharges to maintain recharge of major aquifers at levels equivalent to those of natural conditions.
- Recharge by injection to prevent major flood damage in existing development in flood-prone areas.
- Install filtering devices to precipitate all heavy sediment in runoff prior to discharge from the site.
- Reseed disturbed areas to promote the rapid establishment of protective vegetative cover.

- o Use vegetation and, if necessary, mechanical measures to stabilize streambanks.

- o Control litter to prevent pollutants from reaching watercourses.

Section 404(b)(1) of the Federal Water Pollution Control Act Amendments of 1972 (P.L. 92-500) directs the Administrator of the USEPA to develop and apply guidelines for the discharge of dredged or fill material into navigable waters. The guidelines include the following measures to reduce impacts on wetlands:

Planning Phase

- o Avoid areas near public and private water supply intakes and mollusk, crustacea, and fish concentrations.

- o Minimize loss of fill material to ecosystem by selecting contained areas, avoiding discharge onto steep submerged slopes, and avoiding creation of steep slopes by fill.

- o Discharge onto previous discharge site.

- o Discharge onto suitable upland site.

- o Select disposal site with substrate similar to fill.

- o Minimize changes in substrate elevation.

- o Discharge at time of year to minimize impacts on spawning, nesting, nursery, or migration activities.

- o Disperse fill material widely.

- o Alter volume or rate of discharge to minimize impacts.

- o Design shape and orientation of mound to minimize barriers to currents.

- o Select sites for impoundments that minimize modification of current patterns and circulation.

- o Design access roads and channel-spanning structures to pass high and low water stages.

- o Design discharge to minimize drainage or creation of standing water in areas of fluctuating water stages.

- o Select site to miniize negative impacts on surrounding property owners.

- o Limit number and extent of construction access roads and temporary fills in wetlands.

Development Phase

o Confine discharge zone to smallest area practicable.

o Spread or scatter discharge over large area to dilute impact.

o Minimize loss of fill material to ecosystem by containment levees, sediment basins, cover crops, and lined or impervious containment areas.

o Cap containmented fill material with clean fill.

o Use silt screens or other filtration methods to confine dispersion.

o Use a submerged diffuser system.

o Use chemical flocculants.

o Retain/treat runoff from fill.

o Add oxygen to discharge to remedy deficit.

o Use techniques to disperse fill widely.

o Build culverts, open channels, and diversions that pass both high and low stages, and maintain circulation and faunal movement.

o Use specially designed machinery (wheels, tracks, mats, etc.).

o Protect flood storage capacity of wetlands.

o Protect wetland capacity to buffer other areas from wave action, erosion, and storm damage.

o Protect wetland aquifer recharge capacity.

o Protect wetland wildlife habitat.

Completion Phase

o Consider use of habitat development/restoration methods.

o Maintain and contain fill to prevent erosion, leaching, and slumping.

o Treat sewage and impervious surface runoff to avoid detrimental impacts on receiving waters.

- Restore elevation, substrate type, and circulation pattern as soon as possible after completion of construction.

Other mitigative measures include the following:

- Construct access roads to avoid erodible soils and steep slopes.
- Minimize length and width of access roads.
- Use erosion control devices described in the previous section on earth resources.
- Maintain vegetative buffer between construction areas and surface waters.
- Require site developer to ensure that a reputable portable toilet firm is used and that wastes are taken to a sewage treatment plant.
- Inspect structures slated for demolition for tanks, drums, or other containers holding volatile or toxic substances and ensure that such containers are disposed of properly.
- Ensure that barged refuse is placed in enclosed containers to prevent spills.

Vegetation

Vegetation clearing activities may potentially affect the occurrence of wildlife, windthrow, and disease. Bulldozers and trucks can scrape off the bark of trees, leaving open scars that are prone to disease and insect infestation. Vegetation killed by herbicides is a perfect breeding ground for insects and disease. After drying, this dead vegetation can easily ignite and burn with considerable intensity.

Although vegetation is classified according to the environment in which it is found--either terrestrial or aquatic--the factors for each group are the same. In general, impacts on vegetation will be of little concern in urban environments unless an open space (e.g., a park or recreation area) is affected. Plants can be described and grouped according to their form and structure, and various methods have been devised to classify terrestrial vegetation. Most of these methods consider height, coverage, leaf characteristics, and life forms (trees, shrubs, herbs, etc.). Groupings of aquatic vegetation are much less diversified due to the homegeneity of the aquatic environment. Species composition is the arrangement, mixture, and diversity of vegetative species types in a particular area. For most purposes, this can be an estimate of the percentage of vegetative coverage. Productivity is a measure of vegetation's reproductive capability, usually measured by collecting and examining the quantity and quality of seeds from individual species. Often this procedure is not justified unless the impact is expected to be severe in an area where vegetation is particularly important. The other factors are easier to measure, and impacts on species composition and vegetative density will also affect productivity. Rare and endangered vegetation species are those plants whose continued existence is in jeopardy. In general, they are those species recognized by New Jersey's Department of Environmental Protection, although they may be species identified by local botanists or universities. Information on vegetation may be found through consultations with botanical authorities found at local universities or in state DEP offices. The following discusses impacts on these factors in more detail for terrestrial vegetation.

Terrestrial Vegetation

Form and structure. Impacts on vegetation form and structure result from actions that change their physical form, either as a group or as individuals. These actions may include:

- long-term displacement of portions of vegetation massings by the physical presence of structures
- removal of portions of vegetation for clearance
- die-back from changes in water and soil nutrient availability
- short-term damage from equipment operation and field office and storage yard presence
- changes in solar radiation and wind patterns due to clearing

Species composition. Impacts on species composition result from actions that change the diversity of individuals found in a given area. These actions include:

- long-term displacement by the physical presence of structures
- short-term damage to plants by placement of field offices and storage yards, equipment operation, and disposal of cleared vegetation on top of remaining vegetation masses
- indirect changes in plant nutrient availability due to loss of soil resources
- indirect changes in water availability for plant growth

- changes in soil aeration and root network from grading operations

Density. Construction actions will have a direct impact on vegetation density. Usually it will amount to a temporary decrease in all forms of vegetation during the height of the construction action. The degree of impact can be expressed in terms of the average areal decrease in vegetation population over the acreage affected. Any action that reduces the number of living plants in a given area will have an impact on vegetation density. Such actions include:

- long-term displacement by structures

- temporary removal and damage during construction for access and storage facilities and cleared vegetation disposal operations

- long-term removal caused by vegetation control programs related to off-road maintenance

- long-term removal due to soil loss and the smothering of roots due to soil compaction

- removal by overgrazing from wildlife species

Productivity. The productivity of vegetation usually will be decreased by the impact of the vegetation removal phase of construction and by maintenance programs. The degree of this impact can be expressed in terms of site quality for forests, and its probable change, by change in volume production of tree products, or by change in herbage production or animal grazing of land adjacent to the right-of-way. Any action that changes the density of vegetation will have an impact on vegetation productivity.

Diseases. The impact of various actions upon disease and pathology of vegetation will depend upon the degree to which remaining vegetation has been damaged; the extent to which stands of vegetation have been opened to disease spread; the degree to which trees have been weakened by changes in drainage or the overcasting of soil and fill material around their roots; and the number and size of sites enhanced for the growth of certain shrubs that may serve as hosts for diseases of native vegetation. Essentially any action that causes a stress on vegatation life may precipitate disease in an individual or a plant community.

The impact upon disease in local vegetation can best be assessed by compiling a list of predominant local plant diseases and estimating the effects that the clearing, soil disturbance, and excavation operations will have upon these plant diseases and their spread. Disposal of slash and chippings will have need to be controlled. Subsequent facility operations and maintenance may enhance certain root diseases because of increased soil temperatures and unfavorable changes in water table or soil moisture caused by excavation.

Rare and endangered species. Rare and endangered vegetation is essentially a special group of vegetation types. The impacts on this group are the same as those on other vegetation types, except that the impacts are greater in degree because of their small numbers and sensitivity to change. Usually they will be confined to small and localized areas of unusual topography and soil, such as bogs, seeps, swamps, unusual rock outcrops, shady sites, cave openings, etc. Where such unusual vegetation sites exist, the impact will generally be a complete loss of individuals from the species concerned. The degree of such impact can be assessed by consulting local lists of rare and endangered species and their habitats and estimating the acreage of such sites that will be affected.

Activities That Impact Terrestrial Vegetation

Site preparation. During normal site preparation a good deal of vegetation is removed and scribbed material is stockpiled. At the same time, if care is not taken, machinery can injure the bark of existing trees. Such damage can make them prone to disease and possibly kill them.

Access road construction. Where it is necessary to construct access roads from public streets to either transfer stations or the RRF site, clearing, grading, and earthwork will very often be necessary.

Off-road maintenance. Off-road maintenance can involve burning, cutting, and spraying vegetation with herbicides to control its growth. Maintenance impacts can be fairly large scale along linear features such as pipelines and transmission lines. Vegetation killed by herbicides and debris left after clearing is prone to disease, insect infestation, and fire if not properly managed.

Clearing activities. The factors that are of concern in evaluating the degree of impact from clearing include the following:

- o dimensions of the area cleared
- o comparative rarity of vegetation types affected
- o density of vegetation (number of individuals per unit area)
- o period of time necessary to revegetate the cleared area
- o importance of cleared vegetation to people

Comparative assessments of vegetation impacts from clearing or disturbing land for the RRF, transfer stations, pipelines, or transmission lines initially require an evaluation of the vegetation types affected. Vegetation maps are merely more detailed land use maps that reflect the form and structure, species composition, density, productivity, and hazards of vegetation. Much of this information sometimes can be inferred from a general classification. Examples of vegetation types are oak-hickory forest, sedge meadows, or, less specifically, young hardwood, mature evergreen forest, or open field. Each typing system requires aerial photo interpretation and field verification.

Earthwork: Grading, excavation, and cut and cover activities. Trenching, boring, and tunneling may, in urban and suburban areas, sever or otherwise injure root systems. Such damage can cause die-back or misshapen crowns in affected trees. In rural areas, such excavation damage is unlikely to occur because of the need for clearing of rights-of-way prior to construction. The factors that are of concern in evaluating the degree of impact from these actions include:

- o root growth habits, lateral spread and depth of the specific vegetation types, and sensitivity to root damage (due to time of year and the nature of the specific vegetation type affected)
- o percentage of the plant's total root system destroyed or damaged
- o the season in which the of impact occurs
- o weather conditions immediately prior to, during, and after the activity

There may also be some modification of vegetation productivity because of changes in the soil. Soil fertility, soil structure, and water availability may be changed through soil mixing due to grading and excavation operations. Factors of concern in assessing the degree of impact include:

- o the quantity of soil disturbed
- o the depth to which it is disturbed per unit area

While analysis of vegetation usually requires the skills of a botanist or ecologist, figure 11 and table 11 may assist in making a preliminary determination of potential impacts.

Figure 11. Characteristics of trees common to New Jersey

SPECIES	Mature height (ft)	Mature DBH (in)	Root system	Longevity	Shade tolerance	Growth rate	SUSCEPTIBILITY TO DAMAGE FROM: Wounding	Water table change	Fill over roots	Fire damage	Disease	Insect infestation	Ozone	Chlorine	Hydrogen Fluoride	Hydrogen Chloride	Oxides of Nitrogen	**Peroxyacetyl Nitrate**	Mercury Vapor	Sulfur Dioxide	2, 4 D	COMMENTS
White Ash	80	36	D-S	M	M	M-R	⊕	○	◒	⊕		◒	●	○							○	
Green Ash	60	24	D	M	I-M	M	⊕	⊕	⊕	⊕		●	●		⊕					●	○	Windfirm.
Quaking Aspen	60	18	S	S	I	R	○	○	◒	●	○	○	●							⊕		Southern limit of natural range.
American Beech	90	28	S	L	T	S	⊕	⊕	●	●	○	○										Cannot withstand prolonged soil wetness.
River Birch (Red)	70	24	M	M	M	M										○					●	
Sweet Birch	60	20	D	M	M	M	●	⊕	◒	●										●		
Eastern Red Cedar	50	18	D	M	I	M	○	○	⊕	●	○	○								○		Very susceptible to windthrow.
Atlantic White Cedar	50	18	S	L	M	R	○	●	●	●											●	
Black Cherry	60	24	M-D	M	I	R	○	⊕	●	●		●		⊕		○						Attracts tent caterpillars.
Pin Cherry	50	20	M-D	S	I	R	○	⊕	●	●		●										Attracts tent caterpillars.
Flowering Dogwood	35	12	D	S	VT	M-S		⊕	◒	●	●	●	○									Cannot withstand prolonged flooding.
Box Elder	40			S	I	R			○			⊕	●	●	●							
American Elm	100	48	M-D	L	M	M	⊕	●	○	●		●								●		
Slippery Elm	70	24	M-D	L	M	M	○	○	●	●		●								●		
Black Gum (Tupelo)	60	24	M	M	M	M	⊕	●	●	⊕	○	○	○	○								
Hickories	80	24	D	L	T	S	⊕	⊕	◒	⊕											●	
Honeylocust	80	24	D	M	M	R	⊕	⊕	○	⊕	○		●									
Hop Hornbeam	25	8	M-D	M	T	S	⊕	⊕	⊕	●	○											
Hornbeam	25	8	M-D	M	T	S	⊕	⊕	⊕	●	○											
Black Locust	60	18	S	M	I	R	○	⊕	●	●			●		⊕	●	●			○		
Norway Maple	80	24	S	M	M	R	○	⊕	●	●			○				●			○	●	
Red Maple	70	20	S	M	M	M	○	○	○	●	●	●	○							⊕		
Silver Maple	80	24	S	M	M	R	○	⊕	○	●	●	●	●		●					○		
Sugar Maple	100	36	D	L	T	M	○	○	⊕	●			○	●						○		
Black Oak	70	26	D	L	M	M	◒	⊕	●	⊕			⊕								○	
Black Jack Oak	70	30	D	L	M	M																
Bur Oak	100	36	D	L	I	M		●	○	○	○	○	○									
Cherrybark Oak	120	48	D	L	I	R	○	⊕	○	⊕	●											Northern limit of natural range.
Chestnut Oak	80	30	D	L	M	S	○	○	⊕	○	●											
Overcup Oak	40	12	M	M-S	M-S	M	○	●	●	●								⊕				
Pin Oak	75	30	D	L	I	R	●	⊕	○	●			●	●						○	⊕	
Post Oak	60	24	D	L	I	S	⊕	○	⊕	⊕												
Red Oak	90	24	D	L	M	M	○	⊕	◒	⊕	●		○	○	○					○	⊕	Oak wilt can kill tree in one year.
Scarlet Oak	75	36	D	M-S	I	M	○	⊕	◒	●			●									
Southern Red Oak	75	36	D	M-S	M	M	○	⊕	◒	●												
Swamp White Oak	65	36	M	M	M	M	⊕	⊕	○	○	○							⊕				
Water Oak	100	40	M	M	I	R	○	⊕	●	●	●							⊕				Northern limit of natural range.
White Oak	100	36	D	L	I	S	⊕	⊕	◒	⊕			●							⊕		
Willow Oak	100	36	D	L	I	R	○	●	◒	●	○							⊕				
Persimmon	50	18	M-S	M	VT	S	⊕	●	●	⊕										⊕		
Loblolly Pine	100	50	M-S	M	M-I	R	○	⊕	●	●			●									
Pitch Pine	80	24	D	M	I	M	○	○	◒	●		●	●							●		
Pond Pine	60	12	S	L	I	R	⊕	●	●	⊕										●		
Short Leaf Pine	80	36	D	M	I-M	R	⊕	⊕	◒	○	◒											Windfirm.
Virginia Pine	75	24	S	M	I	R	○	●	●	●			●									Extremely susceptible to windthrow.
Sassafras	50	20	S	S	T	S	○	○	●	●				●							⊕	
Sweetgum	80	30	M-S	M	I	R	⊕			●	○	○	●	●								
Sycamore	120	36	S	M-L	I	R	⊕	○	○	●			●							○		
Tulip Poplar	100	30	D	L	I	R	○	●	⊕	●	●		●						●			Crown subject to break-away in wind.
Black Walnut	90	24	D	L	I	R		⊕	⊕						⊕							
Black Willow	40	14	S	S	I	R		●	○	●			⊕						●	●		

Key:

Root system
(S) Shallow
(M) Moderate
(D) Deep

Longevity
(L) Long
(M) Moderate
(S) Short

Shade tolerance
(VT) Very tolerant
(T) Tolerant
(M) Moderate
(I) Intolerant

Growth rate
(R) Rapid
(M) Moderate
(S) Slow
(VS) Very slow

Susceptibility to damage
○ Low
⊕ Moderate
◒ Moderate to High
● High
☐ No Data

Source: Fowells, 1965; Collingwood and Brush, 1974; Brown and Brown, 1973; Patterson, 1976; Davis and Gerhold, 1976.

Table 11. Sensitivity of crops and flowers to various air pollutants

CROPS	Sulfur Dioxide	Ozone	Peroxyacetyl Nitrate	Smog	Fluorides
Alfalfa	S	S	I	S	R
Apples	I			R	I
Asparagus					R
Barley	S	S	I	I	I
Beet	S		R	R	
Berries				R	
Broccoli	S		R	R	
Brussels Sprouts	S			R	
Cabbage	I			R	R
Cantaloupe	R			R	
Carrot	S		I	R	I
Cauliflower	I			R	
Celery	R			S	
Cherries	R			R	I
Clover, Timothy	S	S	I	I	R
Collards				R	
Corn	R	S	R	R	S
Cotton	S		R		R
Cucumbers	R		R	R	
Eggplant	I			I	
Endive	S			S	
Grapes	I	S		S	S
Kale	I			R	
Leek	I			R	
Lettuce, Head	S		S	I	I
Lettuce, Romaine	S		S	S	I
Lima Bean			R		
Oats	S	S	S	S	I
Okra	S				
Onion	R	S	R	I	
Parsley	I			I	
Parsnip	I			I	
Peaches	I			R	S
Pears	S				R
Pepper	S			R	
Peas	I				
Potatoes, Irish	R	S		I	R
Potatoes, Sweet	S	S		I	S
Pinto Bean			S		
Plums and Prunes	I			R	S
Pumpkin	S			R	
Radish	S	S	R	R	
Rhubarb	S			I	I
Rye	S	S		I	
Snap Beans	S	S		R	R
Sorghum			R		I
Spinach	S	S	I	S	I
Squash	S			R	R
Sugar Beet	I		I	I	R
Tomatoes	I	S	S	R	R
Turnip	S			I	
Wheat	S	S	I	R	R
FLOWERS					
Aster	S			I	I
Azalea			S		S
Bachelor's Button	S				

FLOWERS	Sulfur Dioxide	Ozone	Peroxyacetyl Nitrate	Smog	Fluorides
Begonia	I	S	R		
Chrysanthemum	R	S		I	
Cosmos	S				
Dahlia			S	R	S
Four O'Clock	S				
Geranium		R			I
Gladiolus	R	R		R	S
Hibiscus	R				
Honeysuckle	R				
Iris	I				
Larkspur				S	
Lilac	R	S		I	
Marigold	I				
Nasturtium	I				
Pansy			R	R	
Peony				I	
Petunia		S	S	S	
Orchid				S	
Rose	R			S	I
Shasta Daisy				R	
Snapdragon				I	
Sweet Pea	S			I	R
Sweet William	I				
Tulip				S	
Violet				I	
Wisteria	R				
Zinnia	I			S	

Sources: Brandt and Heck, 1968; Thomas and Hendricks, 1956; *Air Pollution: Proceedings,* 1952; Carlson and Dewey, 1971; Benedict, Miller, and Olson, 1972; Thomas, 1961; Center for Air Environment Studies, 1971.

Key: I = Intolerant
S = Sensitive
R = Resistant

Aquatic Vegetation

Generally, the vegetation impacts on aquatic sites will be similar in character to those on terrestrial sites but shorter term if the hydrology of the site is not altered. This is due to the more homogeneous nature of the aquatic environment and its constraints on vegetation, including soils of poor aeration and uniform organic matter content. Again, the general extent of the impact can be assessed according to acreage of the sites, the vegetation types present on them, and an appraisal of their recovery rates on other disturbed aquatic sites.

Impacts upon the vegetation of aquatic sites will be long term only where construction is carried out to permanently clear vegetation or where rare species are completely eliminated. Otherwise, the aquatic environment will recover quickly if the hydrologic regime of the site has not been altered.

Direct impacts on aquatic communities will occur from earthwork operations related to construction of river crossings and from off-road vegetation control programs. Indirect impacts will occur from changes in water quality.

Activities That Impact Aquatic Vegetation

Underwater structures and maintenance dredging. There will be a limited amount of aquatic vegetation removed during construction of underwater structures at river crossings. The factors that are of concern in evaluating the degree of impact from these actions are as follows:

- dimensions of the trench across the river bottom (area and volume)
- density of vegetation on the river bottom (the number of individuals per unit area)
- comparative rarity of vegetation types affected
- time necessary to revegetate the affected areas
- type of soil disturbed
- water flow patterns and quantities
- sensitivity of affected vegetation to the changes

Trenching for river crossings. Trenching for river crossings may modify vegetation productivity downstream through temporary changes in water quality. The factors that are of concern in evaluating the degree of impact from this action include the following:

- comparative density and rarity of vegetation affected
- sensitivity of the various vegetation types to changes in water quality
- volume of soil disturbed
- construction methods employed
- type of soil disturbed
- velocity of stream flow

Indirect Impacts Associated with Vegetation

The following indirect impacts are likely to occur:

- The changes brought about by the direct impacts on vegetation will be in the microclimate, hydrology, soil, wildlife, and the visual quality of the area.
- The most significant of these will be the effects on soil, particularly with regard to the erosion of soil on steep slopes. Attention will be needed to mitigate the effects of reduction of density of vegetation on steep slopes having erodible soils.
- The clearing of areas will affect the hydrology of sites. Local water tables may tend to rise because of the reduction in vegetative use of groundwater. Surface runoff will increase because of the lowered infiltration rates of the soil and the lack of leaf litter, which increases surface detention of runoff water.
- Microclimate effects will be changes in wind patterns and intensities, increases in extremes of temperature, formation of frost pockets in clearings, and changes in snowdrifting and melting patterns.
- Wildlife population and community dynamics will be affected by changes in the availability of the food and cover provided by vegetation.
- Vegetation massing and form comprise part of the visual environment. Changes in these conditions of vegetation may impact visual quality.
- Certain vegetation massings or individuals occasionally serve as landmarks or provide an identifying characteristic in a town or community. Changes in these massings would have an impact on community identity and cultural features, although such an impact is unlikely to occur.

As with other impacts, the magnitude of these will depend upon the area and the intensity of the direct impacts on the vegetation.

Mitigative Actions

Actions that will mitigate the impact of the cited activities include:

- o Remove as little vegetation as possible during the construction phase and revegetate areas where removal has occurred. Remove all cleared vegetation as quickly as possible.
- o Apply appropriate measures to scraped and scarred trees.
- o Identify any areas containing rare, endangered, or threatened species and avoid damage to both the species and its habitat. Lists of species identified by the State of New Jersey and the federal government are presented in Appendix A.
- o Ensure that spillage does not occur from barges.
- o Limit dredging to as small an area as is necessary.

Wildlife

Wildlife is rarely impacted directly by the activities associated with development. More typically, the activities directly impact wildlife habitats, which, in turn, directly impact wildlife. For example, vegetation removal directly impacts vegetation and indirectly impacts wildlife by changing cover and food supply. In this situation, therefore, it is necessary to first analyze the impacts on vegetation. This kind of analysis begins to reveal the complex interrelationships of the various conditions in the total environment.

Wildlife, like vegetation, is classified according to either the aquatic or terrestrial environment, and the factors are the same for both environments. Perhaps even more than vegetation, wildlife is usually of concern only in nonurban areas. (An exception would be a relatively undisturbed stream that flows through an urban area.) Usually wildlife is important in ares with lots of relatively undisturbed open space. Specially designated open space areas, such as wildlife refuges and land adjacent to refuges, are of particular concern. Wildlife is dependent on vegetation, which is a major component of the species habitat. Because of the interrelationship of environmental components, virtually every component of the biophysical environment could conceivably also have an indirect impact on both vegetation and wildlife.

Changes in the biophysical environment caused by facility construction or maintenance may affect wildlife behavior or population and community dynamics. Behavior refers to the diurnal and seasonal habits of a species. These habits include the activities involved in feeding, breeding, nesting, and securing a territory and shelter. Population dynamics are related to the stability of a species' population. Of concern is the population's growth rate, mortality rate, and density. Community dynamics involve all the interactions among the species that make up a community. The focus is on the food chain and species composition.

Except in the case of gross impacts, it is often difficult to determine when the natural community balance has been initially disrupted. However, declines in the population of a species, sometimes at the expense of another species, become apparent over time, often when it is too late to correct the imbalance. An activity that is detrimental to one species may be beneficial to another. Rare and endangered wildlife species are those species whose existence is in jeopardy. Also, since the same factor will not necessarily have the same effect in two otherwise similar communities, predictability with respect to a particular type of impact is sometimes low. Each land unit, each habitat type, in any area, must be evaluated separately at the time that specific actions are contemplated before a final environmental assessment can be made. What follows, then, are guidelines on broad generalities.

Except for a few isolated instances, rare, endangered or threatened species have not been singled out for special comment. Nor do the symbols used in the impact matrices to denote the length of time the effects of an impact might persist (e.g., short versus long term) pertain to species within such categories. The reasons are: (1) no generalized impact has been identified that would basically affect any one species within a generic group differently from the remaining species of that group; (2) it is safest to assume that any impact on a rare or endangered species is one of long-term duration and consequence.

Before a final environmental impact assessment can be made relative to locating an RRF or transfer station in a specific geographical area, a local evaluation based on either political or, preferably, ecological land units must be undertaken. A generalized procedure would be:

- Obtain an inventory of all wildlife species known to inhabit the area. This can usually be done through the literature and by personal contact with local professional or amateur wildlife specialists. Local sporting and gun clubs may also be a good source of information.

- Determine whether any of the species on the inventory are considered rare or endangered. Both federal and state lists will have to be checked. Appendix A contains the federal list of endangered and threatened species and the official state list from the NJ Department of Environmental Protection, Division of Fish, Game, and Wild life. If it is found that such species may be in the area, the following steps should be taken:

- Identify habitat, food source, water source, breeding, and nesting sites for the species.

- Identify periods when species would be particularly sensitive to construction activities.

o Locate any fish or wildlife refuges or reserves that are within 200 feet of the proposed development or rights-of-way.

o Identify economically important species such as game and consult with local authorities on best times to schedule activities so as to minimize disruption of seasonal hunting.

Responsibility for monitoring and protection of fauna lies within the jurisdiction of a variety of government agencies, both federal (e.g., Fish and Wildlife Service) and state (e.g., NJ Department of Environmental Protection Division of Fish, Game and Wildlife). These agencies should be consulted freely.

A major difficulty may develop in attempting to assess the status of nongame species since there often is less information kept on their status as compared to game species.

Activities That Impact Terrestrial Wildlife

Wildlife can be directly or indirectly impacted. Activities causing both types of impacts are outlined below together with a key word(s) descriptor of the environmental factor affected. This same descriptor will be found in the sections describing the responses of wildlife.

Surface preparation, access road construction, clearing, rock fracturing, and equipment operation. Any of these activities could have the same or similar impacts on wildlife. These impacts include:

<u>Direct impact from ripping, blasting, impact tools, excavation and shoring, soil removal, grading and personnel presence</u>:

o Substrate displacement due to preconstruction exploration and trench construction and filling activities

o Breeding site molestation from humans and domestic pets during all periods when construction and maintenance personnel are in an area

Indirect change in vegetation and earth resources:

- Cover and food change due to vegetation removal, vegetation disposal by piling and windrowing, and thermal soil gradients

- Chemical quality change resulting from herbicide application for vegetation control, and oil leaks

Indirect change in audible quality:

- Noise level alterations due to blasting, vehicle operation, and the operation of above-ground facilities

Visual composition: Individual response. Alteration in the normal or accustomed visual composition of an animal's environment tends to lead to one of, or a combination of, two actions on the part of the individual animal:

- immediate flight and release from stress forces that threaten a permanent disruption in behavior patterns

- an attempt to cope with a changed environment

The result of the latter action can cause a change in behavior that affects reproductive success. For example, some species of rodents will kill their young if subjected to even a slight abnormal psychological stress, or a bird may permanently abandon its nest. A few of the raptorial birds, such as golden eagles, may respond this way. This behavior varies significantly between individuals of a species and is not predictable. This type of impact is usually short term, but it is of long-term consequence to rare or endangered species.

Substrate displacement: Population response. Most vertebrate animals, being actively mobile, will disperse from a point of immediate disturbance. The ones that are liable to direct mortality from activities associated with blasting, excavation, or grading are subsurface- or litter-dwelling species of the following type:

- small adult rodents that normally stay beneath the ground surface at least during daylight hours, such as moles, gophers, and field mice

- rodents that go into complete or semi-hibernation, such as ground squirrels and some chipmunks

- the newborn of several faunal groups

- all reptiles and some amphibians

- possibly some rabbits and hares

The number of vertebrate organisms directly killed from construction activities is expected to be small and should have only a very short-term effect on a population basis.

The density of soil invertebrates is closely associated with soil fertility and structure. The immediate effect of excavation and filling is to drastically change both structure and fertility and consequently the number of microorganisms. Along the trench line this impact may be long term. Even where soil is not removed, populations of invertebrates in the upper few inches of soil can be considerably reduced by debris burning or other forms of organic matter removal. Some of these effects can be moderated by replacing soil strata in the opposite order from that in which they were removed and by avoiding excessive mechanical compaction.

If shoring extends very high above ground level, or if trenches are left open for long distances over a period of several months, this could present an obstacle to migratory animals. Migration is a learned behavior in some animals. If parents are forced to change their route, this change could conceivably persist in future generations. Such obstruction of movement might also have the effect of isolating components of a habitat (perhaps critical components) and thus decreasing overall carrying capacity. In addition, some animals might be forced to reproduce in less than optimal locations. Open trenches or ditches always represent a possible source of mortality for resident animals that are not frightened away by construction activity. This latter condition is apt to exist more frequently in dense vegetation because of ready access to hiding or escape cover.

Breeding site molestation: Population response. The decline in numbers of several of the species currently "endangered" is partly a result of nest or den site predation by humans or domestic cats and dogs. Birds are particularly susceptible to having their nests decimated by egg collectors, even though there are laws protecting some species. For most species this is a short-term impact.

Chemical quality changes: Population response. Most herbicides now in use are so low in toxicity to mammals and birds that when used according to recommended rates of application, no important direct effects have been observed. In addition, all herbicides so far tested in feeding studies with mammals are found to be rapidly excreted. Fragmentary evidence from deer indicates that even when there is ample evidence in the intestinal contents of present or past exposure to phenoxy herbicides, the concentration in the flesh rarely reaches detectable levels. This ruminant is apparently able to degrade these herbicides, almost completely, soon after ingestion.

Since few animals tend to leave sprayed areas for long, the direct consumption of vegetation will constitute the principal exposure to herbicides used in maintaining the accessibility of the rights-of-way. Change of exposure is a function of the persistency of the chemical in plants and soil, while the concentration of residues on vegetation depends on the rate of application, amount of precipitation, and type of vegetation being treated. The time required for one-half of a herbicide residue to disappear from vegetation foilage is one to three weeks. Residue concentration is markedly reduced by precipitation. This is fortuitous because most herbicides are applied at the time of maximum growth rate of target species, which in turn usually coincides with periods of high moisture. But even in the absence of precipitation, residues diminish with time because of growth dilution and metabolism of the herbicide by plants.

There have been reports on indirect effects of herbicides associated with their apparent ability to increase the acceptability to grazing animals of normally nonpalatable poisonous plants. Herbicides may present a hazard to bees and other nectar-feeding insects if the water trapped in flower parts contains concentrated herbicide residues. Toxicological data on the effects of herbicides on reptiles and amphibians are essentially lacking.

In the soil, the activity of most herbicides is short-lived because many microorganisms use the herbicides as an energy source, and this becomes the major factor in the decomposition of these chemicals. A considerable amount of study on the large living organisms in the soil, such as earthworms, mites, and insects, shows no adverse effect.

Oil leaks: Population response. Little or no information is available on the toxicity of low viscosity oil to terrestrial wildlife. Probably different species would be affected differently. It is doubtful that any mortality would occur, but ruminant animals might be more affected because of microorganism populations in the rumen. However, the normal reaction of these animals would be to ignore herbaceous vegetation or areas contaminated with this oil.

Noise level alterations: Population response. There have been only a few studies of the effects of noise on wildlife, and these have added little to out general knowledge. It is suggested that a high noise level can lead to:

- infant mortality through loss of communication between the parent and its young, especially with respect to food-eliciting sounds and distress calls

- hindrance in reproduction due to nondetection of auditory mating signals

If tests on domestic animals are applicable in nature, the most disturbing noises to wildlife would be those that are intermittent and of short duration. Until more is known about the effects of noise, it should be considered a possible short-duration impact of minor importance.

Cover and food changes: Community response. There will be significant long-term changes in species density and composition following removal of timber or brush. The magnitude of these changes will depend to a large extent on the life form of the disturbed community. The impact will be the greatest in forest and dense brushland, as opposed to grass and other open-type situations.

Many forms of wildlife find the conditions created by clearance highly favorable for expansion. Mice and other small mammals quickly take advantage of the new growth favored by increased sunlight, and their populations multiply in the first or second year. Most seed-eating birds are more at home in the openings created by timber removal than in the deep woods. They are quick to utilize the available seed of new forb and grass species.

A majority of big game species thrive on weeds and brush. In an evolutionary sense, most of the adaptive species, such as deer, elk, antelope, and rabbits, developed in an environment subject to frequent disturbances. On the other hand, some wildlife species are clearly associated with and depend upon an undisturbed situation, and it is these species that suffer most from vegetation change. Many of the endangered species are in this category.

Ideally, small openings in forest and brush produce a variety and quality of food for deer that compensates for seasonal deficiencies in surrounding areas. Unfortunately, clearings, in timbered areas at least, are often too small to be of positive significance. As a rule of thumb, if acreage consigned to openings occurs on less than 2 percent of a resident deer herd home range, it is likely to be overbrowsed and quickly decline in quality.

As mentioned above, microorganisms that are necessary to the soil-building process are considerably reduced following soil disturbance and debris burning. However, in the long run the changes in vegetation from most forms of clearing and maintenance will tend to increase vegetation species diversity and to produce subsequent increases in the organic matter near the soil surface and improvements in fertility levels through better nutrient cycling. Microfauna will respond positively to this change.

Chemical quality changes: Community response. The main effects of herbicides on terrestrial communities are the changes brought about in available food and habitat through the control of certain plant species. This change in vegetation can have both a direct and an indirect effect on the food chain for mammals, birds, and insects, particularly where predator-prey relationships are concerned. However, the indirect toxicological effects on wildlife through accumulation and elaboration in food chain organisms have not been shown to be a problem with herbicides as they are with some insecticides. Whether the long-term effect on wildlife through change in habitat conditions is beneficial or detrimental will depend on the species involved. Herbicidal treatment of forested or dense brushy areas improves wildlife habitat and is particularly favorable to game.

Extensive investigations into the effects of herbicides on soil microorganisms have shown that both retardation and stimulation of microbial life occur, but whether or not there are long-term changes in actual species composition is not known.

Activities That Impact Aquatic Wildlife

Aquatic habitats differ from terrestrial habitats in that local disturbances can exert an impact on many miles of stream below the source of origin. There is a normal rate of erosion and change in any watershed, and there are few entities in nature that are as short-lived as a pond or lake. But any activities that leave soil bare during the wet season, destroy vegetation cover--especially streamside cover--or influence water course and volume have the potential to accelerate these natural processes.

Substrate displacement: Population responses. During trench excavation across streams or other bodies of water, organisms directly in the trench line will be killed. This direct impact on benthic populations will be insignificant relative to the total number of organisms involved.

Sedimentation: Population responses. Direct fish mortality can result from damage to gill membrane due to prolonged exposure to high concentrations of suspended sediment. It is not possible to define lethal levels because of the large variation in results appearing in the literature. Laboratory research indicates that concentrations of 200 and 300 ppm may be lethal to cold water species, while warm water species are considerably more tolerant. A still unanswered question is the applicability of these figures to field situations.

Of all the factors affecting aquatic life, bedload sediment and organic fines are the most damaging. Pronounced lethal effects to fish occur during their developmental stages in the gravel. Sediment can both damage eggs by adhesion to the chorion and present a physical barrier to emerging fry. Organic fines tend to decrease dissolved oxygen in the gravel interstices and promote bacteria (Sphaeoitilis) that attack incubating eggs and fry.

Temperature changes: Population responses. Water temperature is a major limiting factor in aquatic ecosystems because the majority of fish and benthic organisms have evolved such narrow tolerances that even moderate thermal pollution may exert an influence. Temperature changes can act as a direct barrier to the movement of river-migrant fish or, infrequently, may result in direct mortality. Lethal temperature ranges have been established in the laboratory for most game fish. They vary with the species and can usually be extended if sufficient time is allowed for acclimation.

Much depends on where within the zone of allowable tolerance a specific stream or species lies under normal conditions. This will in turn determine the degree of temperature change permissible. The stream temperature increases that result from the clearing of vegetation at stream crossings and from cable operation thermal gradients under stream bottoms--less than 2^{o}F for even the smallest streams--are within the natural temperature fluctuations and should not produce measurable effects on aquatic ecosystems. Restoration of shade-producing stream bank vegetation should eliminate any likelihood of long-term temperature effects.

Chemical quality: Population responses. The toxicity of herbicides to fish is a complex problem. It is sometimes unpredictable because each aquatic site presents a unique combination of environmental factors superimposed on the normal variation that occurs between fish of different species, size, and age. Most herbicides have been tested in the laboratory to determine relative toxicity to some of the more sensitive fish, like trout. But even these toxicity ratings may not indicate the actual hazard, or lack of it, to fish because of the circumstances involved in herbicide application under field conditions. For example, the sorptive properties of a compound may play an important role in fish toxicity. There are a few herbicides, like Trifluralin, that are highly toxic to fish but are so strongly absorbed into soil particles that there is little danger to fish from terrestrial applications. The time of year when a herbicide is used may be important. Fish tend to move away when toxic material enters water, but if an accidentally large amount of chemical was to enter a stream near the place where salmonids were spawning, the normal dispersion reaction might not occur. A final complicating factor is that several studies have shown the toxicity of a herbicide to fish to be more dependent on other ingredients in the formulation--such as solvent oils--than on the weed killer itself.

There have been few investigations of the effects of herbicides on plankton. Most of the data in the literature are by-products of studies on aquatic weed control. The few harmful effects that have been noted have all been of short duration, without any biological magnification in the food chain. There is great variation in the reaction of benthic organisms in general and the microcrustacea in particular to herbicides. Some species are very sensitive, while others are very resistant. At present, there is not enough evidence to make generalizations. It is worth pointing out, again, what has already been mentioned in the section on terrestrial wildlife. In the reports originating from a number of sources engaged in pesticide residue studies, the chemicals implicated in significant kills of fish and other estuary wildlife have all been insecticides and not herbicides.

The immediate effect of oil as a surface film on water is to interfere with aeration, leading to a reduction in the amount of dissolved oxygen in the water and substrate. Dissolved oxygen means the amount of oxygen in solution in water. Oxygen levels are important all year round in the surface waters where cold water fish are present, particularly at the time eggs and elevins are developing within the gravel. The decrease in oxygen in surface water should be a short-term change, reversible once the surface film is removed. If a slow leak should develop and a thin film persists for a matter of six to eight months, the low levels of subgravel dissolved oxygen may become a long-term condition.

Stream channel configuration and composition change: Population responses. Temporary cofferdams modify stream channels and flows. Gravel scouring occurs whenever velocities are strong enough. The severity of erosion depends on stream bed gravel composition and water velocity at the site. Redirected current also tends to force gravel away from the upstream face of impediments such as cofferdams. Scouring will occur in any situation where most of the flow is forced through a restricted channel.

Bank erosion could contaminate downstream spawning beds by silting or contribute to the instability of the stream by removing or undermining existing banks. Any resultant widening or rechanneling of the river could then cause the flow in adjacent spawning areas to become too shallow for spawning and incubation later in the season when stream flow reaches a minimum. The net result of most of these adverse effects would be of long duration.

Sedimentation: Community responses. Inorganic sediments have a generally adverse effect on an aquatic food chain. Suspended particles block or decrease light penetration, thus limiting the production of phytoplankton and other aquatic plants. Bedload silt and sand has a low invertebrate carrying capacity. It is also an unstable habitat, and organisms inhabiting it are particularly vulnerable to decimation by redirected currents or flood waters. Consequently any introduction of inorganic material in excess of what a stabilized body of water is normally accustomed to handling often results in a rapid reduction in the diversity of benthic organisms, a displacement or burial of organic food matter, and a subsequent change in the fish populations.

Increased sedimentation, if of long duration, results in a change in species composition. Some fish groups, such as the cyprinids, castomids, and cottids, are naturally species of clear water, while many minnows and bottom-dwelling fish prefer more turbid conditions.

Temperature changes: Community responses. Species composition and distribution within a watercourse can be governed by temperature. The optimum temperature range for one species may be 10° to 15°F higher than the optimum range for another. Since the shift of maximum temperature is nearly always upward, this generally means a change in favor of many of the less desirable sport fish. Such temperature changes are not likely to occur when underground transmission systems are used.

Indirect Impacts Associated with Wildlife

- o Land use: Significant changes in wildlife populations may affect the use of an area for recreation (hunting, fishing, observation, etc.) in a positive or negative manner. Maintenance of rights-of-way could have a positive effect by providing additional cover and food habitat, and thereby increasing the carrying capacity of the area, for some game species. A negative effect would result if the spawning grounds of popular game fish were destroyed if water quality so altered as to not permit their survival.

- o Economic and community resources: Changes in land use may affect community resources. An increase in sportsmen would require lodging and dining facilities, while a loss of sportsmen would result in the reverse economic condition.

- o Vegetation: Wildlife overgrazing or overpopulation on rights-of-way can adversely affect vegetation on the rights-of-way and adjacent areas.

Mitigative Actions

The following are generalized procedures that have proven effective:

- o Anytime it is necessary to construct above ground or to obstruct potential wildlife migratory paths or normal habitat by leaving open ditches, a break should be left every 400 to 600 feet to allow animals to cross.

- o Attempt to keep personnel from disturbing nesting sites or dens; using vehicles off-road and outside the immediate area of necessary construction activity; or engaging in any unnecessary disturbance of wildlife, such as displacing the logs and large rocks that are so frequently habitat for reptiles and amphibians.

- o Avoid use of methods and equipment that have been identified as main offenders.

- o Maintain right-of-way vegetation in such a way as to maximize its benefit as a part of the habitat for terrestrial fauna.

Land Use and Cultural Patterns

Existing land use refers to the spatial arrangement of different land uses over an area. Dependent on the degree of development, large areas are referred to as either urban, suburban or rural. The most common land use categories are residential, commercial, industrial, institutional, agricultural, parks and open space, transportation, utilities, mineral extraction, forests, conservation, and wilderness.

The structural or functional and locational relationships of land uses may be discussed at the local level in terms of the compatibility of uses and the physical or visual linkages or barriers among them. At the city or regional level, discussions may also refer to the type and pattern of development.

Land use compatibility has traditionally been regulated by zoning, which assigns land to very specific types and intensities of use based on such assumptions as the need for separation between residential, industrial, and commercial uses. Even within a use category, planning and zoning guidelines often call for a gradation of intensity of use (e.g., from low- to high-density residential). Current practice is changing, however, in favor of establishing compatibility on the basis of standards relating to the impacts on noise, air quality, and water quality generated by an activity; traffic generated by employees, visitors, and service vehicles; the intensity of land use; and the height, bulk, and visual quality of structures required for the activity. Adherence to specified performance standards may allow a greater mix of land uses under modern plans and ordinances. For example, planned unit developments provide clusters and mixtures of compatible commercial, residential, institutional and open space land uses. Nevertheless, the separation of certain functions is still desirable, through, for example, the use of open space or transportation corridor buffers between industrial and residential land uses. A second major change has been brought about by the view that reliance on the automobile should gradually diminish. Greater provision is now made in local planning for pedestrian or bicycle path links between functionally related uses. The importance of visual links or barriers and continuity of scale, which are more apparent to the pedestrian than to the motorist, is now more widely recognized. Existing land uses can be determined by windshield surveys, aerial photographs, and land use maps.

Linkages between areas refers to visual experiences and circulation linkages. Transportation includes vehicular, pedestrian, bike, rail, and navigational modes. Circulation linkages connect different areas with different land uses. Transportation corridors may also be used to separate and buffer various land uses, although notable examples abound where highways have divided cohesive neighborhoods. The development criteria for circulation patterns differ according to the type and intensity of the transportation mode. The NJ Department of Transportation can supply road and highway maps; local planning offices have pedestrian and bike paths; and the US Army Corps of Engineers has information on navigational channels.

Zoning ordinances and land use plans attempt to establish future land use patterns. The focus of land use plans may range from local areas to large regions, with the degree of detail varying accordingly. However, a major development or a series of developments can shape future development patterns. Although land use plans describe what planning officials have decided should be the future land uses for an area, any major development has the potential not only to conflict with the plans, but also to provide impetus for other associated and conflicting land uses. Although land development projects have the potential to alter the day-to-day life of people in the area, decisions to pursue a development are generally based on economic and biophysical criteria, with little regard for community patterns and functions. However, in recent years, recognition of the importance of community functions and cohesion has been highlighted by successful community resistance to publicized development projects. Perhaps the most important aspect of community identity and cohesion is stable neighborhoods, including their links to desired services. Disturbance of neighborhoods has the potential to severely disrupt community identity and cohesion; however, careful placement of some developments may help shape and define existing neighborhoods and other land uses.

The identification of a neighborhood affected by a new facility in immediate physical terms is relatively easy. However, its residents may consider themselves part of one or several communities or interest groups that include residents of other neighborhoods. Such community identifications may be based on ethnic or cultural values and concepts, social-economic status, and patterns of everyday life that may vary with age.

Those who value independence and individualism are more likely to prefer to live with more space around them, while those who place a higher value on convenient location will prefer smaller living spaces and mixed uses. Lower-income groups are more likely to have close relationships with neighbors, while middle-income and upper-income groups tend to have a wider community of friends and interests. Families with children are less likely than childless adults and the elderly to prefer diversity and easy access to shopping and community facilities. These patterns and preferences will affect the attitudes of residents toward the presence and use of a development. The other components of a community with which it members identify and to which they attach significance vary for each community. These components may be referred to as cultural features. Cultural features are unique features or characteristics of a specific area. Examples of possible cultural features include community centers, parks, town halls, museums, archaeological or historic sites, and areas of national, state or local significance. In short, any structure or area that is unique to a community and important to its inhabitants can be referred to as a cultural feature and can be identified through interviews with key informants.

Activities That Impact Existing Land Use

The general concern in assessing the land use impacts of an RRF, transfer station, or support facilities such as a cable and pipeline system is to minimize the amount of direct disruption or destruction of viable land uses and significant features and to avoid adverse alteration of use relationships and social patterns.

The existing and future use of land is impacted by any activities that require the removal of structures or acreage to accommodate the facility, access roads, station sites, and site offices and storage yards or that allow multiple use of the site.

Preconstruction planning activities, clearing and relocation of structures, and right-of-way maintenance. Two factors that should be considered when reviewing the impacts of these activities are:

- o Amount: displacement of existing uses or structures due to clearing, possible conflict with public and private plans, and the removal of option to develop future uses due to cable installation and establishment of multiple uses

- o Ownership: change as a result of fee acquisition of land by the utility and alteration of existing parcel configuration due to right-of-way routing

The siting and clearing activities, which require the removal of structures and the removal of land from its existing use, produce the most direct impacts.

While the approval and permit process can prevent many major conflicts with existing significant uses, the routing of a pipeline or transmission system and siting of transfer stations on any land, including vacant land, forecloses the option to change its use in the future and may conflict with public or private plans for its future use. This could affect plans for any type of development either restricted approximately to the right-of-way, crossing it, or in the vicinity and including the right-of-way. Examples include subdivisions that would have to be redesigned to make allowance for the right-of-way; industrial and commercial development and special uses such as reservoirs, which could be totally precluded to make allowance for the right-of-way; and infilling of vacant parcels in urban areas.

Significant factors influencing the magnitude of direct land use impacts include:

- o the number of structures to be demolished and the availability of relocation housing of an appropriate type, location, and price range

- o the number of land ownerships traversed or users affected

- the amount of land particularly suited to high-intensity uses

The amount of land likely to remain unused or undeveloped because small or awkwardly shaped parcels are created by noncontiguous rights-of-way and property lines and the reduction in the possibilities for future use of a given parcel due to bisection by the right-of-way are also significant. In developing areas this type of impact on land ownership will be particularly serious in areas to be used for industrial development because industrial plants vary far more than residences in their dimensions and it is hard to pre-plan lot sizes to appeal to particular prospects.

The temporary use of vacant lots or land in other low-intensity uses for offices and material storage will have an insignificant impact.

Activities That Impact Land Use Relationships

The location of an RRF transfer station, pipeline, or cable system has the potential for direct adverse or beneficial impacts at both the township and regional levels. The siting of transfer stations to a limited degree may also impact the local land use structure. In addition, relationships may be affected by indirect changes in the quality of use.

Preconstruction planning activities. Factors that are important to consider when reviewing land use relationships are:

- Compatibility: change as a result of locating right-of-way or transfer station adjacent to incompatible use or as a result of buffering by the right-of-way

- Linkages: change due to blocking or creation of physical or visual linkages by facilities or right-of-way

- Pattern: opportunity for influence on development pattern through facility location and the right-of-way routing process

The siting of transfer stations in locations that are separate from existing landfill and industrial districts may introduce an incompatible semi-industrial activity in certain areas. Station siting in a residential area may be inadvisable in view of the secondary noise, visual, and public health and safety impacts of construction and operation.

An off-road pipeline or cable right-of-way may, of itself, create undesirable relationships or may offer opportunities for improving existing relationships in the long term by:

- interrupting the continuity of scale of a developed or developing area
- creating a barrier between neighborhoods or bisecting a single neighborhood. This is only likely to occur in suburban areas and is unlikely to occur very often even there. Even where public access to the right-of-way is permitted and pedestrian movement is not seriously impeded, there may still be a visual separation creating buffers between areas in different uses. This may be beneficial where the uses are not compatible, such as heavy industrial and residential uses, and may allow the planting of a strip of vegetation to buffer the noise and often the appearance of industrial structures. In general, an off-road right-of-way is probably unlikely to divide land in one use from land in another since such separation will usually be made by streets. However, a right-of-way might perhaps be routed between the rear of a community shopping center and a residential development where often the only separation is a service alley. Besides a planted strip and the additional setback, the right-of-way might provide additional parking.
- allowing planned development of pedestrian or bicycle path linkages between uses. For example, a residential area might be linked to a neighborhood school, shopping center, or park.
- allowing multiple use of the right-of-way not only for other activities but also for parks in urban areas, increasing the acreage in open space and the proximity and ease of accessibility to parks for residential areas adjacent to the right-of-way.

When a cable right-of-way is being routed through an area where a sprawling pattern of development is essentially established, it may be difficult to use a utility corridor to reorient growth. In fact, the routing process itself may be complicated by the difficulty of avoiding developed off-road areas.

Activities That Impact Circulation

The location of a facility or the routing of a pipeline or cable system and activities associated with its construction and maintenance may directly impact pedestrian and vehicular circulation systems and other transportation routes in both the short and long term.

Preconstruction planning and construction activities. The following circulation patterns may be affected by these activities:

- o urban vehicular traffic: disruption due to construction in streets, use of roads by construction equipment and vehicles, removal of parking and blocking of driveways

- o pedestrian traffic: inconvenience due to disruption of pedestrian street crossings, use of sidewalks for equipment and storage, relocation of bus stops, and blocking of paths or trails

- o road and rail traffic: minor occasional disruption due to equipment hauling and construction at road and rail crossings

- o navigation: interruption during construction

Cable right-of-way routing and maintenance and repair activities.

- o Urban pedestrian and vehicular traffic: circulation patterns may be disrupted due to maintenance and repair activities which may result in the blocking of existing pedestrian routes and the creation of new routes.

Disruption of traffic due to closing of lanes will be most significant in the case of directly buried cables, which require installation in entire sections. However, covering the trench with steel plates reduces the time traffic is obstructed. The significance of traffic obstruction due to construction will depend upon the availability of alternative routes, particularly for emergency vehicles. Obstruction of a major street is more serious in a city with an irregular or radial street pattern than in one based on a grid. Normally, construction or maintenance and repair activities will only contribute significantly to congestion during commuter hours.

Use of parking spaces by construction workers and removal of access to parking spaces or driveways may be a significant inconvenience to motorists and will have indirect economic impacts in commercial areas.

Due to construction worker travel, delivery of materials and equipment, and hauling of earth and backfill, the traffic volume increase on local streets and roads during construction could have considerable effect. The large trucks used to transport materials and eventually solid waste travel at a low speed and have poor maneuverability. They could conceivably obstruct traffic flow on a two-lane road and at road intersections. Such a situation is apt to be a major problem on already congested roads.

Disruption or improvement of pedestrian routes, as discussed above, is likely to occur in off-road routes wherever developed areas are traversed, but particularly in suburban areas. Children tend to use paths and short cuts to neighborhood parks and are most likely to be inconvenienced or benefited by changed patterns.

Interruption of pedestrian movement in urban areas will be a general inconvenience, but the groups most seriously affected are likely to be the poor and the elderly. However, this impact is not of great significance, being limited to the short period of construction.

Interruption of rail traffic is unlikely to occur, since cable crossings can be made overhead or by boring or tunneling. By contrast, the impact of construction on navigable waterways, and particularly those open to large commercial vessels, is significant because traffic in most cases is halted or restricted.

Activities That Impact Community Identity

Many socially related issues have already been raised in connection with the discussion of impacts on physical land use and functional relationships and the compatibility of routing, siting, and multiple use development with local plans. Others are raised in the discussion of health, safety, and comfort impacts on individuals and the public at large. Nevertheless, it is well to draw together here the potential impacts and opportunities related to community and neighborhood cohesion and character and to the goals and attitudes of interest groups.

Activities That Impact Community Cohesion

The location of RRFs and the routing of a pipeline or cable can significantly reinforce or divide neighborhoods or other functional units, depending upon how linkages or buffers are planned. Community features, needs, and perceptions are more sensitive to impacts on the order of those associated with an RRF than is often apparent from examination of plans and reports and discussions with local planners. Attitudes that have been expressed in the past in relation to one issue may not be the same in relation to the location of an RRF facility or transfer station or the routing of an underground transmission line. The anticipated adverse impacts may include:

- the noise and visual and traffic disruption of construction activities

- similar impact on comfort and convenience from disruption due to maintenance activities

- physical or visual separation from other homes or community facilities perceived by residents

- loss of privacy or linkage to neighborhoods or uses with which links are not desired due to possible multiple use of the right-of-way

- the noise and visual intrusion of stations

- possible safety hazards due to construction activities, operation and maintenance activities, and the proximity of unpatrolled right-of-way open space

- loss of convenience and "openness" due to interruption of access paths from homes to local facilities by the right-of-way

Activities That Impact Unique Cultural and Biophysical Features

Cultural features include scientific or archaeological sites; historic sites or structures that have statewide, national, or purely local significance; natural landmarks such as hills, rock outcrops, old trees, or important stands of trees; and views either of or from important areas of open space. The evaluation of the historic, scientific, and social values of cultural resources has often been limited in the past.

The impacts of a facility location on cultural features are predominantly direct. Destruction of features or sites may occur as a result of construction activities, including vegetation removal, grading and trenching. Destruction may also result from overuse if public access to the right-of-way opens up previously little-used areas. Indirect visual quality impacts due to the proximity of the right-of-way and stations or views of them will also detract from the setting, aesthetic value, or unique character of historic sites and natural landmarks.

The value of a natural, historic, or archaeological site is determined by the site's importance in history, the degree to which it is preserved, the amount of information known about it, and its scientific or interpretive potential. A major part of the value of archaeological and historic sites lies in the artifacts that lie buried in the earth. Reconstruction of the events that occurred at each site demands a record of the exact position, condition, and nature of these artifacts. For the purpose of evaluating archaeological resources, existing sites must be located and identified. The danger of destroying an undiscovered source is probably greatest in routing cables in river-crossing scenarios, since streams and lakes are usually the most frequent locations for historic and archaeological sites.

Attitudes towards environmental preservation may be very divergent. While government agencies are charged with the responsibility for environmental protection, their perceptions of what are acceptable impacts or tradeoffs with other considerations such as cost may differ from those of local residents or interest groups. Such a divergence of views could slow down the process of gaining approvals and permits for a project.

Indirect Impacts Associated with Land Use and Cultural Patterns

Economic and community resources. The types of land use change most likely to be reflected in indirect impacts on economic and community resources are ownership and quality. Reduction in the amount of land in existing productive use or suitable for development will have both fiscal and economic impacts at the local level.

The loss of land in agriculture, forestry, or mineral extraction due to cable and station land requirements will be compensated in terms of the direct market value of the land, crops, and any improvements lost. However, the removal of the land, resulting in loss of the land's productive value and perhaps adversely affecting the efficient use of the remaining land, will have an economic cost, although this is likely to be minor.

Changes in the amount and quality of land available for commercial recreation will be reflected in an increase or decrease in the demand for lodging, dining, and retail facilities.

The interruption or disruption of transportation routes will have secondary economic impacts that in the case of traffic delays are likely to be minor but in the case of blocked access to businesses could be severe.

Public health, safety, and comfort. Changes in land use and land use relationships resulting from off-road right-of-way routing and station siting, especially in residential areas, may be reflected in residents' perceptions of the safety, convenience, and ambient comfort of their environment. The types of positive or negative impacts perceived will depend heavily on how well the right-of-way relates to community land use patterns and whether and in what ways multiple uses involving public access are developed.

Mitigative Efforts

During the site selection process, the presence of archaeological/historic sites should be one of the criteria applied. This would involve consulting with the office of Cultural and Environmental Services in the NJDEP. In addition, neighborhoods should not be disturbed by site construction or by the routing of truck routes.

Economic Resources

Economic resources refer to components of the private economic market. Real estate values vary according to the land uses and property values of adjacent parcels. The values of equal-sized adjacent parcels with comparable land uses will be about the same. However, developments that change land uses or the quality of a particular use will change not only the value of that particular property, but also the value of adjacent properties. In some cases large-scale developments or land use changes may affect real estate values regionally. This occurred when casinos began development in Atlantic City at the same time that development regulations were enforced for the Pinelands. The effects of the casino development and the newly restricted land areas in the nearby Pinelands combined to cause dramatic escalations in real estate values in the Atlantic City region. Real estate values can be obtained from appraisers, real estate brokers, or assessed values for taxes.

Assessment of the impact of the activities listed below can be amended by reviewing comparable situations where a similar facility has already been built in another area and comparing real estate values before the proposed use of the site was announced to the values after the facility was built. These changes in values can be applied to the proposed site area. Knowledgeable real estate brokers and asessers can also be interviewed.

Employment refers not only to the increases or decreases in available jobs due to a development but also to the types of jobs affected. Predictions of the number of anticipated jobs required to construct and maintain a specific development are rather easy to obtain. The number of jobs lost or replaced by a particular development may be more difficult to estimate, especially if a commodity or service is produced that replaces the need for another one. Developments that encourage additional money to be spent in an area often have a multiplier effect that may modify employment patterns. Employment changes may extend beyond the local or regional level; for instance, a manufacturing plant may relocate from the Northeast United States to the sunbelt area. The type of jobs and the level of skill required can also be reviewed when discussing impacts on employment. Overall, many direct changes in employment (e.g., new jobs created in constructing and operating a proposed facility) may be estimated fairly easily, while many of the indirect impacts on employment (e.g., multiplier effects) are much more difficult to discern.

An estimate of employment figures for site preparation and construction activities can be obtained from contractors familiar with this type of work. The proposed operator of the facility can provide estimates of the labor force needed to operate it.

The local economic base comprises the local economy of an area and the changes that occur to its sales, productions, rentals, leases, and manpower. Construction activities in urban or suburban areas may affect adjacent businesses by disrupting local shopping patterns, for example, by limiting parking spaces and disturbing pedestrians with noise and dust. The economic base is closely related to employment patterns. Virtually any of the changes in employment patterns mentioned previously will affect the economic base.

Activities That Impact Economic Resources

Right-of-way acquisition: public. Right-of-way acquisition for public lands involves the permitting of public lands to be used in the resource recovery system. This use includes the transfer station and RRF sites and land necessary for road improvements. Acquisition for the sites will impact adjacent property values. It would generally be expected that real estate values would decrease for properties adjacent to the sites; however, if the sites are large and well buffered, then the impact on real estate values may be negligible.

Right-of-way-acquisition: private. Fee simple acquisition of private land will affect real estate values by establishing a price per unit of land that can be used for comparison purposes when adjacent land is being sold. The impacts on adjacent properties will be the same as those for right-of-way acquisition of public lands. The money paid to the owner of the land will be an addition to the local economy.

Site preparation: relation to existing improvements. Site preparation work may have a short-term negative impact on adjacent real estate values, particularly if the site work is visible from roads and adjacent land.

General construction: labor force. The labor force will have a short-term beneficial impact on employment and the local economic base. The majority of the work of constructing the RRF should be accomplished within a year, and it will take less time to build the transfer station. Peak employment at the RRF site should rise to about 120 people, most of whom will be from the local labor pool. It is estimated that about 50 percent of the workers' earnings is expendable and will generate new retail sales and services. This will bolster the local economic base.

Clearing: vegetation removal and disposal. The removal of vegetation that was once visible in adjacent properties may diminish the real estate value of those properties, particularly if the vegetation was scenic.

Road/intersection improvement construction. Road/intersection improvements that occur in front of stores and commercial services, detour traffic away from them, or reduce parking spaces will impact the local economic base. The degree of impact depends on the stability of the business, its ability to advertise to offset the disruption, the availability of comparable businesses, the duration of the construction, and the availability of alternative parking.

Existence of improvements. Once the transfer stations and RRF are constructed, their physical presence and the associated activities may tend to lower real estate values. The degree of impact will depend on the size of the site and how well it is buffered. If the site is large and well buffered and revegetated, it may have a positive effect on real estate values, since a prospective buyer would be assured that the land would not be developed. This would be more important in more urbanized areas.

Truck traffic and hauling. If truck traffic increases significantly, it may tend to lower real estate values of property along heavily traveled roads. This would probably occur only on roads servicing the RRF and feeding directly to it.

Labor force. The labor force employed at the RRF and involved in transporting wastes will add to the area's employment and economic base. Typically, between 40 and 50 people will be employed at the RRF. The number of people hauling wastes may not change substantially, since that activity--i.e., hauling wastes to landfills--is currently taking place. About 50 percent of the workers' earnings will generate new sales and services.

Indirect Impacts That Affect Economic Resources

Changes in real estate values may affect land use, although it would be quite difficult to generalize about what types of changes would be expected.

Mitigative Actions

To diminish the potential negative impact on adjacent real estate values, attempts should be made to:

- purchase a parcel of land large enough to buffer the transfer station and the RRF from adjacent properties
- design the site in a manner that will shield the structure from views outside the property
- retain as much vegetation as possible

Community Resources

Community resources are all facilities and services designed to serve the community as a whole. Community services include community centers, health services, schools, park and recreation areas, libraries, museums, fire companies, water systems, wastewater systems, waste disposal, etc. Most of these services are supported by public funds. Increased demands on community services caused by a development are generally the result of the demands that individuals associated with the development make on those services. Since most of the labor force is expected to be local, the impacts on community services should be negligible.

Infrastructure refers to services that form an intensive network to meet the needs of the community. They include utilities (gas, electric, telephone, sewer, water, steam, etc.) and transportation systems. In contrast to community services, most of the demands on infrastructure are the result of a large demand by the development at one point of the network. For example, additional sewer lines may be needed; roads serving the development may need to be improved; water may be needed for cooling purposes. In addition, construction activities may temporarily disrupt services provided to a small area. Finally, employees at a large development, particularly if it is in a rural area, may cause a significant increase in demands on the infrastructure. Whether this happens would be dependent on the number of new employees as compared to the total population of the area and the capacity of the service provided. Information from the proposed operator should identify the exact infrastructure needs of the facility, and discussion with the owners of the concerned infrastructure service about that service's capacity will provide the basis for assessing the facility's impact.

Activities That Impact Community Resources

General construction: disposal of wastes. Disposal of wastes at the transfer station site and the RRF site will probably be by truck hauling. Its impact on the waste disposal system will be short term and minimal.

Road intersection improvement construction. Since gas, sewer, and water lines often follow roads, any road intersection improvements may temporarily disrupt or cause alterations in the delivery of infrastructure services.

Disposal and pickup of waste. This is part of the resource recovery system, which is a community service--that is, the disposal of waste. It is expected that this service will be improved by the resource recovery system.

Waste disposal. The region's waste disposal system will be improved with the operation of an RRF. Temporary storage of wastes could potentially affect potable water sources; thus, it should be done in a manner that will not degrade potable water from local wells.

Electricity generation. A product of the RRF could be electricity, which would help satisfy its demand.

Sanitary water system. Wastewater from the RRF will increase the demand on the sanitary wastewater system, and a sanitary sewer line to the RRF will have to be constructed.

Dredging and filling. The disposal of dredged materials could potentially affect potable water sources; therefore, it should be done in a manner that will not degrade potable water from local wells.

Indirect Impacts That Affect Community Resources

Any new sewer line to the RRF may encourage improvements along the new line. No other indirect impacts are anticipated.

Public Health, Safety, and Comfort

The environmental elements in this category are the most difficult to assess because measurements of them are usually not quantifiable and projections of future levels are often tenuous. Nonetheless, it is important to identify the potential effects of a development on public health, safety, and comfort.

Public Health

Public health refers to the health status of a population and the means by which its health is maintained. A potential effect of any development on public health is the release of toxic or carcinogenic substances into the air, soil, or water. However, many questions remain about the effects of various pollutants and disposal methods, although many associations have been made between a population's health status and levels of various pollutants in the environment. The sections on atmosphere, earth resources, and water resources discuss the effects of substances released on those components of the biophysical environment.

Activities That Impact Public Health

Temporary waste storage. During temporary storage, rats and other vermin may have a food source. This can be eliminated with proper storage. In fact, vermin control should be less of a problem at an RRF than at a sanitary landfill.

Mitigative Actions

Ensure that all waste storage facilities are properly secured from vermin infestation and that appropriate rodent-control measures are undertaken.

Public Safety

Public safety comprises three elements. Risk to injury refers to any accident that may occur to those employed at a development as well as to the public at large. Accidents are often associated with construction activities. Accidents to employees or others are completely dependent on the type of development. The risk of a fire and the risk to property and services are also dependent on the nature of the activities associated with the development. In some cases, it is possible to review accident records of similar develop ments in an attempt to estimate the risks involved in the construction and operation of a particular type of development.

Activities That Impact Public Safety

General construction, clearing, and equipment maintenance. There is a possibility that workmen may sustain injuries while involved in any of these activities.

Existence of improvements. The location of a building in the vicinity of a sanitary landfill introduces a risk of gas seepage through the floor of the structure. Odorless methane, emitted by decomposing wastes, can accumulate in enclosed spaces, such as closets, and reach potentially explosive concentrations.

Truck traffic and hauling. There is a risk that trucks may be involved in traffic accidents while hauling solid waste. There is also a possibility that the number of accidents per unit of time of truck operation may increase if the volume of truck traffic increases on portions of roads, particularly roads that previously had low volumes of truck traffic (e.g., residential roads), or on roads that should be improved to accommodate truck traffic. An increase in truck traffic may also further aggravate the problem in areas that currently have a high accident rate. Changes in the hauling system that might promote increased accident levels would be the use of more trucks and the use of roads not suitable for heavy truck use. Past truck accident records, if they were kept, should be compared to accident rates once the RRF is in operation.

Mitigative Actions

The following measures may be taken to mitigate changes that may adversely affect public safety:

- An emphasis by supervisors on proper equipment operation and maintenance may instill an awareness in workers that will result in improved accident rates.
- Developers should refrain from site preparation work during periods of inclement weather--e.g., periods of heavy precipitation.
- The operators of the RRF should install sensors in their facilities that will alert people to the presence of potentially explosive gases.
- An increase in accident rates during the hauling of solid waste may indicate a need for driver education,

road/intersection improvements (if the data indicate a high accident rate at one location), or the use of different roads.

Public Comfort

Certain activities may be nuisances or threats to the public comfort. Three elements--noise quality, visual quality, and fumes and odors--are often associated with disturbances to other environmental components. The disturbance to humans of destructive or unwanted sound is subjectively defined. Noise is of concern when it has an effect on environmental components. Audible quality is characterized by its volume (measured in decibels), frequency, duration, number of noise sources, the distance of the receiver, and ambient noise levels. The time of day is also of concern. Construction noises at night in residential areas would not be appropriate, though they might be in purely commercial or industrial areas.

NJDEP's noise control regulation (7:29-1.2) places a limit of 65 decibels in the A scale on noise between 7 AM and 10 PM. Assessments of the noise levels associated with the activities listed below should consider their abilities to keep noise within regulated levels.

Determining visual changes is relatively easy, but assessing whether the changes are aesthetically pleasing or disturbing is purely a subjective judgment. A view may be characterized by the uniqueness of its elements and the manner in which the elements are composed. The view may be further described in terms of the element's characteristics of scale, texture, form, color, and distance. Scale is the relative size of the object compared to its surroundings. Distance from the object is a factor, and the perceived scale will vary in urban, suburban, and rural settings. Texture is the roughness or pattern of the object compared to its surroundings. Form describes the object's three-dimensional mass in terms such as soft or hard, vertical or horizontal, round or angular. The color of an object can be compared with its surroundings. Distance is often described in terms of foreground, middleground, and background.

When assessing changes in visual quality, it is necessary to identify the perspective of the majority of the viewers and the orientation of any development in the view. An outline of important considerations is presented in table 12. Consideration should also be given to the development's location in terms of foreground, middleground, and background, which is addressed in table 13.

Fumes and odors are smells resulting from the release of gaseous matter into the atmosphere. They are distinguished from the other components of air quality in that their smell is disturbing and there are people within the area affected by the fumes and odors who will be disturbed by them.

Table 12. Factors of significance in evaluating local impacts on visual quality

Characteristics of the Subject Being Viewed	Characteristics of the Surrounding Landscape	Characteristics of the Viewer, Viewpoint, and Other Variables
o Color	o Color	o Viewer
o Form	o Texture	- Numbers
o Texture	o Terrain--land form	- Sensitivity
o Quantity & Grouping	o Vegetation--density & height	- Attitude
o Height & Width	o Visual Character	- Mood
o Area or Length	- Panoramic	- Expectations
o Movement	- Feature oriented	o Viewpoint
o Other Impacts (noise, odors, etc.)	- Enclosed	- Orientation with respect to subject
o Scale	- Focused	- Quality (e.g. scenic road, trail, historic, site, wilderness area, industrial area, dump, city street, etc.)
	- Canopied	- Distance from subject
	o Landscape Variety	- Motion relative to subject
	o Scale--relative to viewer	o Other Variables
	o Ambient Visual Quality	- View duration
	o Cultural Setting	- Atmospheric conditions
	- Wild	- Season
	- Pastoral	- Light
	- Suburban	
	- Urban	
	- Industrial	

Source: Rogers, Golden & Halpern.

Table 13. Distance variation in urban-suburban and rural scenarios

	Foreground	Middleground	Background
Visual Characteristics	o Presence--the observer is in it. o Maximum discernment of detail--in proportion to time and speed. o Scale--observer can feel a size relationship with the elements. o Discernment of color--intensity and value seen in maximum contrasts. o Discernment of other sensory experiences--sound, smell, and touch. o Aerial perspective absent.	o Linkage between foreground and background parts of the landscape o Emergence of overall shapes and patterns. o Visual simplification of structures and vegetative surfaces into textures. o Presence of aerial perspective--softens color contrasts. o Discernment of relation between landscape units.	o Simplification--outline shapes, little texture or detail apparent, objects viewed mostly as patterns of light and dark. o Strong discernment of aerial perspective--reduces color distinction, replaces them with values of blue and gray. o Discernment of entire landscape units--drainage patterns, vegetative patterns, landforms, o Individual visual impacts least apparent.
		Rural	
Distance	0-¼ - ½ mile	¼-½ - 3-5 miles	3-5 miles - infinity
Subjects Viewed	Tree, rock, creek, farm house individual plants & species	Ridge, valley, river, textures (conifers & hardwoods)	System of ridges, valleys, patterns (light & dark)
		Urban-Suburban	
Distance	Immediate street & adjacent block 0 - 500 feet	Adjacent blocks 200 - 1000 feet	Several blocks 500 - 3000 feet
Subjects	Vehicles, pedestrians, signs doorways, lights, colors.	Buildings, crowds, textures.	Building masses, patterns, skylines.

Source: Electric Power Research Institute and U.S. Energy Research and Development Administration, 1975.

Activities That Impact Public Comfort

Access road construction. Construction and use of the access road will affect the visual and audible qualities of the transfer station and RRF sites. Visual characteristics can be described in terms of the considerations listed in tables 12 and 13. The change in view will be significant if the access road presents a large contrast to the previous view. The noise during construction will come largely from construction machinery; during operation it will come from solid waste collection trucks.

General construction: equipment operation. The audible and visual quality of the sites will be impacted for a short time during the construction phase. The impacts will be diminished as the viewer's distance from the sites is increased and to the extent vegetative and landscape buffers exist or as they are grown or installed.

General construction: material delivery and handling. The consideration involved in assessing these impacts should be essentially be the same as that for the previous activity.

Clearing: structural demolition. The noise associated with structural demolition should be a very short-term problem. The destruction of a structure will result in the disappearance of that structure from the view of the site. However, it is likely that the view of the transfer station or the RRF will partly replace any previous structure.

Clearing: vegetation removal and disposal. On a site with with plenty of vegetation, its removal is probably the biggest consideration in assessing visual quality. The loss of extensive amounts of vegetation will significantly alter the visual character of the site (as well as the landscape character). On the other hand, careful site design and vegetation removal can result in a view that mitigates site development. Structures can be screened by retaining vegetation between the buildings and roads and developments adjacent to the site. The impact of vegetation removal will be negligible if the vegetation consists of grasses or low shrubs without any trees.

Earthwork: pavement breaking. The equipment used in breaking pavement will create loud noises for a short time. This may be particularly annoying during road improvements in developed areas. It will be most disturbing if repair work is done in residential areas.

Earthwork: surface grading. The noise from necessary machinery will have a short-term impact. The most important considerations are the level, time of day, and distance from dwellings.

Grading may change the visual character of the site, depending on the degree to which the slope is changed and any associated vegetative changes. The slope should be less than it previously was unless a berm or hillock is made to buffer the facility.

Earthwork: rock fracturing. Loud short blasts from impact tools and explosive material are associated with rock fracturing. Important considerations in assessing the impact are determining the noise level, the time of day the activity will occur, and the distance from dwellings. Workers should wear ear protectors to dampen the noise.

Earthwork: cut and cover excavation. The necessary equipment will produce noises similar to those produced in grading.

Earthwork: backfill and restoration. The impacts will be similar in nature to those of grading activities, but on a smaller scale.

Existence of the structure. The existence of an RRF or transfer station will obviously alter the visual quality of the site. As mentioned, the prominence of a structure can be diminished with careful site design and the use of vegetative and landscape buffers. It is most important to assess the views most likely to be seen by the public. Views from nearby areas that are heavily used--e.g., parks--will be of concern. Photos of these views with the structures superimposed will facilitate their assessment. The information contained in tables 12 and 13 in the introduction should be employed in assessing the impact on visual quality.

Disposal and pickup of wastes. The disposal of wastes may generate noise to a degree that will require the workers to wear ear protectors.

Temporary waste storage. The design of the transfer station should be such that the draft will blow inside the container, thus minimizing fumes and odors. However, there is a possibility that fumes and odors may be a problem. The impact will depend on the distance to areas where people congregate.

Truck traffic and hauling. If truck traffic is concentrated on certain road sections, then the volume may exceed 65 decibels at 50 feet. Any such area should be checked. In addition, a large volume of trucks on roads that previously had light loads will impact visual quality. It may be helpful to survey roads that will be heavily used before and after the initiation of the collection system to assess the impact of truck traffic.

Disposal of dredge materials. The disposal of dredge materials will affect the visual quality of the disposal sites and it will also create fumes and odors. The impact on visual quality can be ascertained through photographs or sketches. The impact of the odor will depend on the distance to areas where people normally congregate.

Indirect Impacts Associated with Public Comfort

Noise will disturb any wildlife in the area, but this will be a concern only in rural areas. The visual quality will affect the character of the landscape. If the smell of fumes and odors goes beyond the site's boundary, then real estate values and possibly land use relationships may be impacted.

Mitigative Actions

The following are mitigative measures to ensure public comfort:

- o Retain as much of the visual character of the affected area as possible through the use of careful site design and landscaping that would include the retention of as much vegetation as possible

- o Ensure that vegetative buffers exist around facility sites, particularly if non-industrial uses are adjacent to the sites

- o Restrict construction activities to normal working hours

- o Require workers exposed to high noise levels to wear ear protectors

- o Design transfer stations so that drafts blow inside the container, thus minimizing fumes and odors. Ensure similar ventilation in the RRF through the use of fans which draw fresh air through the entrance of the storage area directly into the furnace for use as combustion air. This should minimize both odors and dust in the reception area.

- o Avoid routing heavy truck traffic on roads adjacent to noise sensitive land uses (e.g., hospitals, schools, etc.).

- o Schedule high noise levels from equipment operations to coincide with times when noise levels are normally high.

- o Use mufflers and/or buffers and engine enclosures on all equipment.

- o Provide a site design that complements its surrounding.

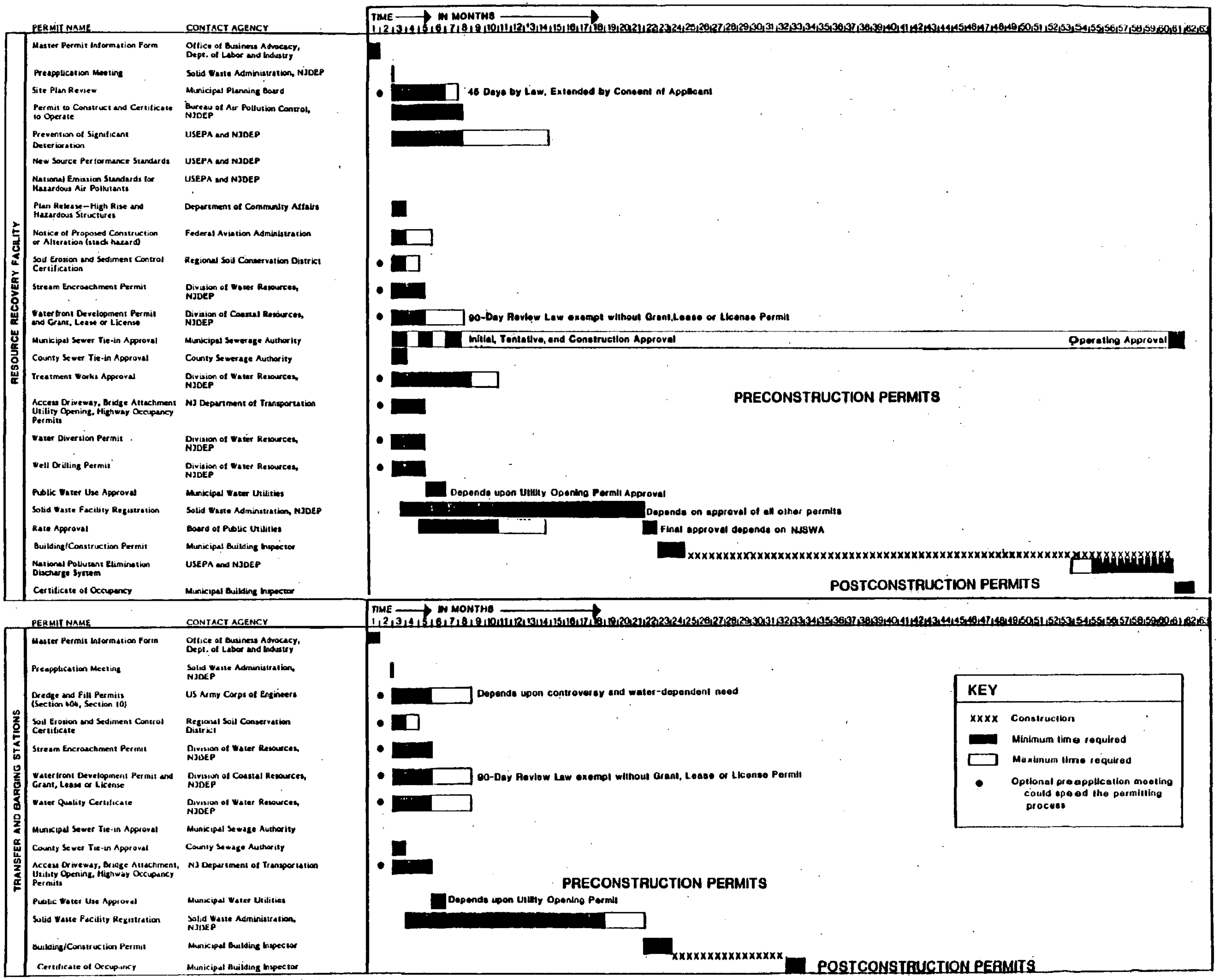
- o Avoid disturbing prominent landforms if possible.

- o Curve the access road approach behind a vegetative screen shortly after it is within the boundary of the site.

PERMITS AND AGENCY REVIEWS

The construction and operation of a resource recovery facility and associated facilities require numerous permits and approvals at all levels of government. Figure 12 summarizes the permitting process for the development and operation of an RRF in New Jersey. This process is described in detail in Appendix B.

Figure 12. Permitting process for RRF development and operation in New Jersey



Source: Rogers, Golden & Halpern.

CHAPTER 3. APPLICATION OF THE ENVIRONMENTAL ASSESSMENT GUIDEBOOK TO THE PROPOSED EAST BRUNSWICK RESOURCE RECOVERY FACILITY

SOURCES AND VOLUMES OF SOLID WASTE

In order to evaluate the effects of a proposed resource recovery facility, it is necessary to understand the existing solid waste disposal system serving the study area. At the early stages of this study, both Middlesex and Union counties were assumed to contain the major generators of the solid waste that would be transported to the proposed East Brunswick facility for processing. When information became available concerning a proposed RRF in Rahway that would serve a portion of Union County, this project's study area was modified to include only Middlesex County. The following inventory of solid waste volumes and sources, however, covers both counties.

Current Waste Generation

The total volume of solid waste generated in Union and Middlesex counties in 1978 was approximately 5,877.5 tons per day (TPD), based on a 300-day year. The waste was almost evenly divided between municipal and industrial/commercial waste. The Middlesex County Solid Waste Management Program, District Plan Modifications, July 1980 (MCSWMP), indicates the volume of municipal and industrial/commercial waste generated by each municipality. The plan notes four municipalities in which the reported figures are assumed to be in error because they differ substantially from 1977 figures. Summing the 1978 figures in the MCSWMP with 1977 figures substituted for the appropriate four municipalities results in a total of 3,101.4 TPD for Middlesex County, of which 1,903.0 (61 percent) were municipal waste and 1,198.4 (39 percent) were commercial/industrial waste.

There are two sources of waste volume data for Union County: the Union County Solid Waste Management Plan (UCSWMP), June 1979 and updated in January 1980, and information provided by collectors and haulers serving Union County. There is a major discrepancy between the two sets of figures, and it is assumed that the true volume of generated waste is probably somewhere between the two. Averaging the two data sets yields a total of 2,776.1 TPD of waste for Union County, of which approximately 40 percent is municipal waste and 60 percent is commercial/industrial waste.

Future Waste Generation

Neither county has made projections of future waste volumes. The following is a simple calculation of future waste generation based on extrapolation of county data and on the assumption that per capita generation of municipal waste will remain unchanged.

Assuming a constant volume of generated waste per person, the volume of future municipal waste will depend on population changes. The 1980 census population for Middlesex County was 595,893 persons; an average of .96 tons per year (TPY) of waste is generated per person. The MCSWMP estimates a population of 815,300 for the year 2000. Assuming a constant of .96 TPY per person, the estimated volume of municipal waste for 2000 is 2,609 TPD--a 37 percent increase from 1978.

The Union County 1980 census population is 503,057 persons, each generating an average of .66 TPY of municipal waste. The UCSWMP projects a population of 529,900 for the year 2000; thus, the estimated volume of municipal waste for 2000 is 1,170 TPD--a 5.4 percent increase.

The projected volume of municipal waste for 2000 for both counties is 3,375 TPD. This represents a combined estimated increase of 766 TPD, a 25.4 percent increase.

Another projection based on residential waste uses USEPA's estimate that 3.30 lbs of waste are generated per person per day. This results in an average of .60 TPY per person. Using population estimates of 1,345,200 persons for both counties for the year 2000, the total amount of residential waste generated would be 810,146 TPY or 2,700 TPD. However, this calculation uses USEPA estimates of residential waste, while the previous calculation is based on municipal waste rates. Municipal waste includes residential waste as well as any other waste collected by the municipality. Therefore, the waste per capita estimate is greater in the first calculation.

These projections must be viewed as very rough estimates tempered by the following conditions. The constant per capita value of tons per year of waste used 1980 census figures and 1978 residential waste volume figures. In addition, the population projections used in the county plans are probably high. This is because the plans used estimates prior to the 1980 census count and population growth was slower than anticipated. The MCSWMP's estimated 1980 population was 5.7 percent higher than the actual 1980 population, according to the 1980 census, and the UCSWMP's estimated 1977 population was 4.3 percent higher than the census figure. Moreover, Union County's population may not increase at the rate projected in the UCSWMP: census figures indicate a population decrease of 8.0 percent between 1970 and 1980, while Middlesex County's population figures for the same period show an increase of 2.1 percent.

Estimates of future changes in commercial/industrial waste volumes would be even more tenuous than estimates of future residential waste, and so none are provided.

Waste Disposal

In 1979, the total volume of waste disposed in Middlesex County was 8,579 TPD, of which 4,937 TPD (57.5 percent) were generated from within the county. Three disposal sites--I.L.R. (4,131 TPD), Edgeboro (2,550 TPD), and Global (1,352 TPD)--accepted most of the waste generated in Middlesex County.

The waste flow table for Middlesex County (table 14) indicates the disposal sites for each municipality. Most of the county's municipalities north of the Raritan River deposit their waste at I.L.R. and Edison Municipal. These facilities are scheduled to close in December 1981, at which time all solid waste generated north of the Raritan is designated to go to the proposed landfill #1. However, it appears likely that landfill #1 will not be ready to receive waste until January 1982.

The municipalities south of the Raritan River deposit their waste at Edgeboro, South Brunswick Municipal, and Global disposal facilities. Global is scheduled to terminate in December 1983, and South Brunswick Municipal is scheduled to terminate in December 1984. When these facilities close, the waste from the municipalities south of the Raritan River is to be directed to the proposed landfill #2. For the purposes of this report, a worst case is assumed, which is that the Edgeboro RRF, which is scheduled to be operational by January 1985, is to accept all processible waste generated in Middlesex County.

Until recently, most of Union County's solid waste was deposited at the Hackensack Meadowlands facilities, but, as the Union County waste flow table shows (table 15), most of it now goes to the I.L.R. facility in Middlesex County. A small portion of the total volume still goes to Hackensack Meadowlands, as well as to Combe, Edgeboro, and Linden, which is the only disposal facility in Union County. I.L.R. is scheduled to close in December 1981, and neither the UCSWMP nor Union County's Certification of Approval indicates where the displaced waste will go. However, there are plans to construct an RRF in Rahway capable of handling 2,080 TPD; it should be operational by 1984. At that time, 10 of Union County's 21 municipalities are scheduled to direct their waste to the RRF. According to the 1978 data presented in table 15, these 10 municipalities produce 1,610.1 TPD, or 58 percent of Union County's total waste.

Table 14. Waste flow by municipality for Middlesex County

Municipality	Total generation (TPD/1978)	Disposal by site (TPD/1978)		Planned disposal by site 1980	1981-1982	1983-1984	1985-1990
Carteret	156.4	109.2 15.5 15.4 6.2 3.7 .8	Global I.L.R. Carteret Mun. Edison Mun. Arace Bros. Other Sites	Global	Landfill #1	Landfill #1	Resource Recovery Facility
Cranbury	20.7	13.5 5.5 1.0 .8	Lone Pine Cranbury Mun. 1208y Other Sites	Global	Global	Global (1983) Landfill #2 (1984)	Resource Recovery Facility
Dunellen	23.4	9.6 7.3 3.5 3.0	I.L.R. Edgeboro Edison Mun. Plainfield T.S.	I.L.R.	Landfill #1	Landfill #1	Resource Recovery Facility
East Brunswick	205.5	185.9 12.3 3.5 1.3 2.2	Edgeboro Global J.I.S. I.L.R. Other Sites	Edgeboro	Edgeboro	Edgeboro	Resource Recovery Facility
Edison	587.7	246.3 178.7 108.4 15.7 14.7 13.0 10.2 .6	Edison Mun. I.L.R. Global Combe S.L.F. J.I.S. Edgeboro 40999 Other Sites	Edison Mun.	Landfill #1	Landfill #1	Resource Recovery Facility
Helmetta	24.4	22.8 1.5 .1	Edison Mun. I.L.R. Other Sites	Edgeboro	Edgeboro	Edgeboro	Resource Recovery Facility
Highland Park	33.9	31.6 1.9 .4	Edison Mun. I.L.R. Other Sites	Edison Mun.	Landfill #1	Landfill #1	Resource Recovery Facility
Jamesburg	26.3	14.6 11.2 .4	Stanley Olbry's James', Inc. Other Sites	Global	Global	Global (1983) Landfill #2 (1984)	Resource Recovery Facility
Metuchen	NO DATA	NO DATA		Edison Mun.	Landfill #1	Landfill #1	Resource Recovery Facility
Middlesex	130.3	92.0 17.5 12.6 7.7 .6	Edgeboro Middlesex Mun. I.L.R. Edison Mun. Other Sites	I.L.R.	Landfill #1	Landfill #1	Resource Recovery Facility
Milltown	15.0 (Assumed error, 36 TPD reported in 1977)	9.5 5.4	Edgeboro Combe S.L.F.	Edgeboro	Edgeboro	Edgeboro	Resource Recovery Facility
Monroe	15.9	11.2 5.4 2.2 .1	James (Mercer Co.) Edgeboro Etsch Other Sites	Global	Global	Global (1983) Landfill #2 (1984)	Resource Recovery Facility
New Brunswick	273.5	227.5 25.2 14.1 3.8 1.5 1.5	Edgeboro 1201Y I.L.R. Combe S.L.F. Edison Mun. Other Sites	Edgeboro	Edgeboro	Edgeboro	Resource Recovery Facility
North Brunswick	209.6	207.9 1.1 .7	Edgeboro I.L.R. Other Sites	Edgeboro	Edgeboro	Edgeboro	Resource Recovery Facility
Old Bridge	28.3 (Assumed error, 155 TPD reported in 1977)	11.5 8.3 7.6 .8	Global Edgeboro J.I.S. Other Sites	Global	Global	Global (1983) Landfill #2 (1984)	Resource Recovery Facility
Perth Amboy	218.7	208.9 4.6 4.1 1.1	Global Edison Mun. I.L.R. Other Sites	Global	Landfill #1	Landfill #1	Resource Recovery Facility
Piscataway	125.9	60.9 45.9 13.4 2.9 1.7 1.2	I.L.R. Edison Mun. Edgeboro Arace Bros. Runnells S.L.F. Other Sites	I.L.R.	Landfill #1	Landfill #1	Resource Recovery Facility
Plainsboro	11.1 (Assumed error, 26.0 TPD reported in 1977)	8.5 2.6	Plainsboro S.L.F. Other Sites	S.Brunswick Mun.	S.Brunswick Mun.	S. Brunswick Mun.	Resource Recovery Facility
Sayreville	45.7	41.4 1.6 1.6 1.1	Global I.L.R. Edgeboro Other Sites	Global	Global	Global (1983) Landfill #2 (1984)	Resource Recovery Facility
South Amboy	8.6	8.0 .6	Global Other Sites	Global	Global	Global (1983) Landfill #2 (1984)	Resource Recovery Facility
South Brunswick	94.9	43.5 21.9 21.1 4.7 3.7	S. Brunswick Mun. B.F.I. S.Brunswick J.I.S. 1427D Edgeboro	S.Brunswick Mun.	S.Brunswick Mun.	S.Brunswick Mun.	Resource Recovery Facility

Table 14. (cont'd)

Municipality	Total generation (TPD/1978)	Disposal by site (TPD/1978)	Planned disposal by site 1980	1981-1982	1983-1984	1985-1990
South Plainfield	67.3	33.7 I.L.R. 14.3 S. Plainfield Mun. 8.5 Edgeboro 7.4 Edison Mun. 2.9 Arace Bros. .5 Other Sites	I.L.R.	Landfill #1	Landfill #1	Resource Recovery Facility
South River	52.4	48.7 Edgeboro 1.9 Global 1.7 J.I.S.	Edgeboro	Edgeboro	Edgeboro	Resource Recovery Facility
Spotswood	25.2 (Assumed error, 18.7 TPD reported in 1977)	25.1 Edgeboro	Edgeboro	Edgeboro	Edgeboro	Resource Recovery Facility
Woodbridge	490.3	407.8 Global 52.0 I.L.R. 19.2 Edison Mun. 6.3 P&M Sanitation 2.3 Arace Bros. 1.6 Edgeboro 1.0 Scientific Chem. Proc.	Global	Landfill #1	Landfill #1	Resource Recovery Facility

Source: Middlesex County Solid Waste Management Program, District Plan Modifications, July 1980.

Notes

- Data for Total Generation (TPD/1978) and Disposal by Site (TPD/1978) were obtained from the Middlesex County Solid Waste Management Program, District Plan Modifications, July 1980.
- Data for Planned Disposal by Site were obtained from the Certification of Approval with Modifications of the Middlesex County District Solid Waste Management Program, July 1980.
- TPD figure is based on a 300-day work year.
- Waste to be accepted at the planned disposal sites excludes liquid waste, sewage sludge, septage, hazardous waste, oil spill clean-up waste, infectious waste, and waste separated and recovered at the point of generation.
- The Resource Recovery Facility will accept only processible solid waste as defined in the Solid Waste Management Program.
- Some disposal sites are identified only in terms of the disposal site number.

Table 15. Waste flow by municipality for Union County

Municipality	Total generation (TPD/1978)	Planned disposal by site
Berkeley Heights	45.9	I.L.R. (through 1981)
Clark	87.0	I.L.R. (through 1981)/Union Co. RRF (beginning 1984)
Cranford	109.6	I.L.R. (through 1981)/Union Co. RRF (beginning 1984)
Elizabeth	557.8	I.L.R. (residential through 1981)/Union Co. RRF (1984) Global (nonresidential through 1983)/ Union Co. RRF (beginning 1984)
Fanwood	26.8	I.L.R. (through 1981)
Garwood	33.7	I.L.R. (through 1981)
Hillside	117.0	I.L.R. (through 1981)/Union Co. RRF (beginning 1984)
Kenilworth	68.9	I.L.R. (residential through 1981)/ Union Co. RRF (beginning 1984) Edgeboro (nonresidential)/Union Co. RRF (beginning 1984)
Linden	311.8	Linden landfill (residential)/Union Co. RRF (beginning 1984) Edgeboro (nonresidential)/Union Co. RRF (beginning 1984)
Mountainside	52.3	I.L.R. (through 1981)
New Providence	80.5	Combe landfill
Plainfield	168.8	I.L.R. (through 1981)
Rahway	207.2	Edgeboro/Union Co. RRF (beginning 1984)
Roselle	85.3	I.L.R. (residential through 1981)/ Union County RRF (beginning 1984) Edgeboro (nonresidential)/Union Co. RRF (beginning 1984)
Roselle Park	60.7	I.L.R. (through 1981)/Union Co. RRF (beginning 1984)
Scotch Plains	92.9	I.L.R. (through 1981)
Springfield	99.2	Hackensack Meadowlands Dist.
Summit	137.3	Combe landfill
Union	305.1	Hackensack Meadowlands Dist.
Westfield	123.5	I.L.R. (through 1981)
Winfield	4.8	I.L.R. (through 1981)/Union Co. RRF (beginning 1984)

Table 15. (cont'd)

Source: Union County Solid Waste Management Plan, June 1979, updated January 1980; and data about solid waste haulers provided by Union County.

Notes

- o Data in the total generation column are averages of values obtained from collector/hauler figures and data compiled by a consultant for the county. The decision to use averaged values was based on a personal communication with Joseph Kazar of the Union County Department of Engineering and Planning.
- o Data in the planned disposal by site column are from the Certification of Approval with Modifications of the Union County District Solid Waste Management Plan.
- o TPD figures are based on a 300-day work year.
- o Waste to be accepted at the planned disposal sites excludes liquid waste, sewage sludge, septage, hazardous waste, oil spill clean-up waste, infectious waste, and waste separated and recovered at the point of generation.
- o Disposal of future waste for some municipalities after the closing of existing facilities is not indicated in available documents.
- o The resource recovery facility will accept only processible wastes as defined in the Solid Waste Management Plan.

Capacity of the Proposed RRF

The proposed RRF will be designed to initially process 400,000 TPY of waste with expansion capabilities to include an additional processline that would increase the processible waste volume to 600,000 TPY. The plant is expected to be able to process both municipal and commercial/industrial waste. Figures for 1978 indicate that 930,420 TPY of both municipal and commercial/industrial waste were generated in Middlesex County. The estimated volume of municipal waste for 2000 is 782,700 TPY. With a processible capacity of 600,000 TPY, the RRF would be processing about 65 percent of the 1978 total solid waste volume (municipal and commercial/industrial) and about 76 percent of the estimated 2000 municipal waste volume for Middlesex County.

Existing Recycling Programs

The MCSWMP states that by 1990, 14 percent of the county's waste should be recycled. Presently, less than one percent is recycled. The county Department of Solid Waste has identified 45 existing recycling programs (table 16). Weights of recyclables collected have been determined for 31 of these programs (table 17). Commercial recycling and private collectors of recyclables are not accounted for in the weights.

Some capital expenditures may be eliminated by RRFs if sufficient quantities of recyclables are separated at the source of waste generation. However, the present volume of less than one percent recyclables would result in virtually no change in capital expenditures, and recycling programs would have to increase dramatically before expenditures would be affected.

Recycling programs also have an effect on the BTU value of waste. Newsprint recovery reduces the BTU content of the solid waste stream, while its separation will offset higher disposal fees. Glass recycling enhances the BTU content of refuse-derived energy by eliminating a key contaminant in the fuel's preparation. The complete elimination of metals would not be desirable, since metal components of the waste agitate the fuel bed on the grates.

The proposed RRF will be designed to operate without the benefit of recycling programs because of the uncertainty of the ability to maintain any consistent waste stream modification through programs that remove significant percentages of recyclables.

Table 16. Middlesex County recycling programs, June 1981

Municipality	Sponsor	Materials	Collection method	Schedule	Comments
Carteret	St. Mary's Holy Name Soc.	p	drop off	anytime	
Dunellen	Sponsor's Club	p	drop off	Tuesday	
	Girl Scouts	p, g, a, b	drop off	2nd Saturday	
East Brunswick	Township	p, g, a, b	drop off	anytime	
	Old Bridge Fire Co.	p	curbside	last Saturday	
	Brookview Fire Co.	p	curbside	1st Saturday	
	High School Band	p	drop off	bi-monthly on Saturday	
	St. Barts Altar Boys	p	—	—	Infrequent collections
	Boy Scouts	p	curbside	1st Sunday of month	
Edison	Lions Club	p	curbside	Monday	
	St. Thomas Aquinas High School Band	p	drop off	Last weekend	
Highland Park	Rutgers Recycling	p, g, a, b	drop off	anytime	
Jamesburg	Knights of Columbus	p	curbside	2nd Saturday	
Metuchen	High School PTA	p	drop off	2nd Saturday	
	Borough	p, g	p—curbside g—drop off	p—every week g—anytime	
	St. Joseph's H.S.	p	—	—	Infrequent collections
Middlesex	Rutgers Recycling	p, g, b, a	drop off	Saturday	Infrequent collections (3–4 times per year)
	High School	—	—	—	
Milltown	Boy Scouts	mixed p	curbside	1st Saturday	
New Brunswick	Rutgers Recycling	p, g, b, a	drop off	anytime	
North Brunswick	Dept. Public Works	p	curbside	each resident once every 2 weeks	
	Boy Scouts	p	curbside	last Saturday	
Old Bridge	Southwood School	a	drop off	school hours	
Perth Amboy	Volunteer Fire Co.	p	curbside	usually Saturday	
	Most Holy Rosary Church	—	—	—	Infrequent collections
Piscataway	Our Lady of Fatima Church	p	drop off	anytime	
	Super Chief Band Parents Assn.	p	curbside	last Sunday	
	St. Frances Cabrini Holy Name Soc.	p	curbside	4th Sunday	
	St. Pius X H.S.	p	—	—	Infrequent collections
Sayreville	Knights of Columbus	p	curbside, drop off	1st Saturday	
	Jaycees	g	drop off	anytime	
	Bruno & Delia	p	drop off	Tues, Thurs, Sat	

Table 16. (Cont'd)

Municipality	Sponsor	Materials	Collection Method	Schedule	Comments
South Brunswick	American Legion	mixed p	curbside	1st Sunday	
	Knights of Columbus	p	drop off	anytime	
	6-Mile Run Reformed Church	p, a	drop off	anytime	
South Plainfield	Boosters of the Musical Arts	p	drop off	1st Saturday	
	Pilgrim Covenant Church	p	drop off	—	Infrequent collections
South River	Lions Club	p	curbside	1st Sunday	
Spotswood	Boy Scouts	p	curbside	3rd Saturday	
	Volunteer Fire Co.	p, b	curbside	—	
Woodbridge	Township	white goods	curbside	each resident once a week	
	Elks	p	drop off	anytime	
	Fords Lions Club	p	curbside, drop off	last Sunday	
	Boy Scouts	p	curbside	1st Saturday	
	Colonia H.S.	p	drop off	anytime	
	St. John Vianney	—	—	—	Infrequent collection

Notes:
p = paper
a = aluminum
g = glass
b = bi-metal

Source: Middlesex County Department of Solid Waste, 1981.

Table 17. Weights of recyclables collected

Material	Reported total tons/month
Paper*	262.90
Glass	39.92
Aluminum	.48
Bi-metal	2.61
White goods	24.28
Total	330.19

Source: Middlesex County Department of Solid Waste, 1981.

*This does not include corrugated or office paper.

POTENTIAL ENVIRONMENTAL IMPACTS OF THE PROPOSED EAST BRUNSWICK RESOURCE RECOVERY FACILITY

Potential environmental impacts of an RRF are displayed graphically in the impact summary matrix (figure 13). This matrix applies to RRFs in general, reflecting all possible impacts; it does not apply specifically to the proposed East Brunswick RRF. Not all of the environmental components indicated on the matrix will be affected by the East Brunswick RRF. The matrix groups impact sources into preoperation activities and operation and maintenance activities. The following discussion parallels this grouping: the first section reviews the impacts of preoperation activities on affected environmental components and possible mitigative actions while the second section focuses on operation and maintenance activities. Since the construction and operation of an electrical transmission line between the RRF and the substation encompass a large number of activities, they are discussed separately at the end of preoperation activities and operation and maintenance activities sections.

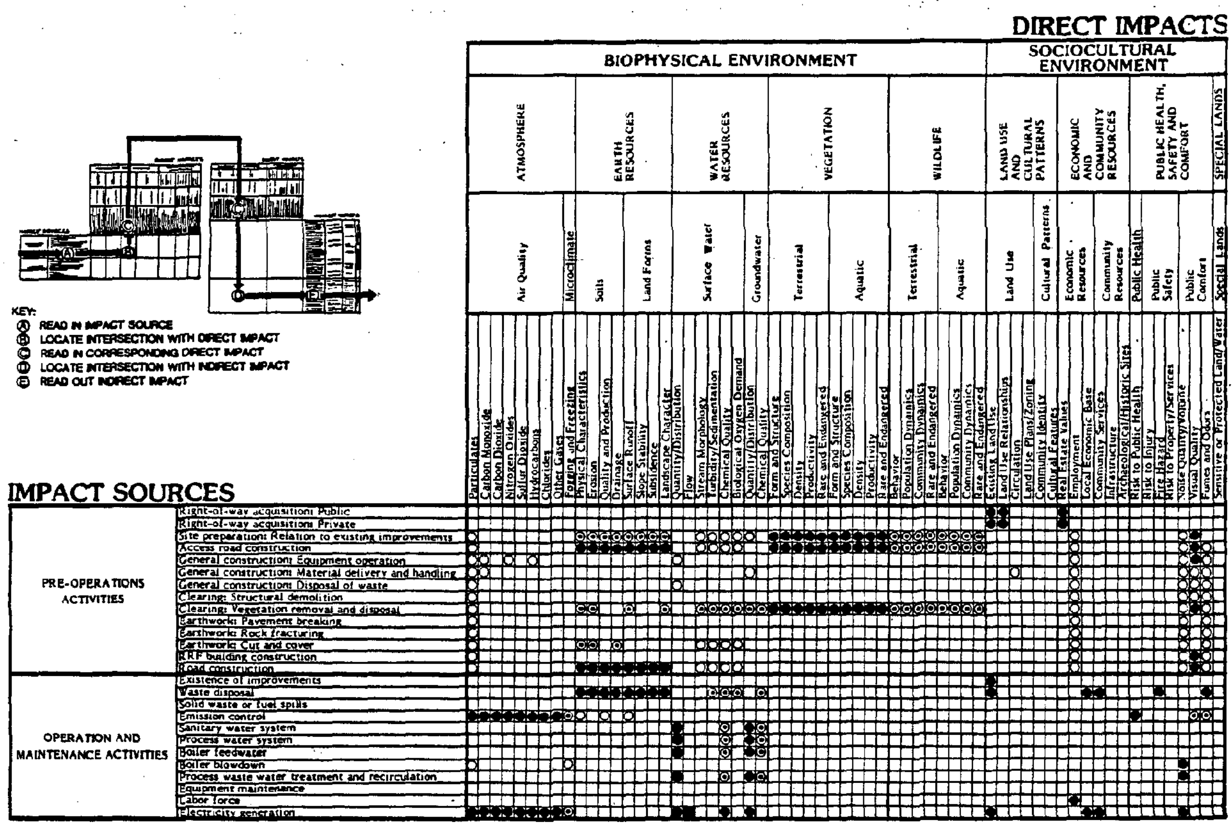
Preoperation Activities

Atmosphere

Air pollutants associated with the construction of the RRF and the transfer stations are expected to originate in vehicular and heavy equipment exhaust emissions and other fugitive sources, notably construction and roadway dust and dirt.

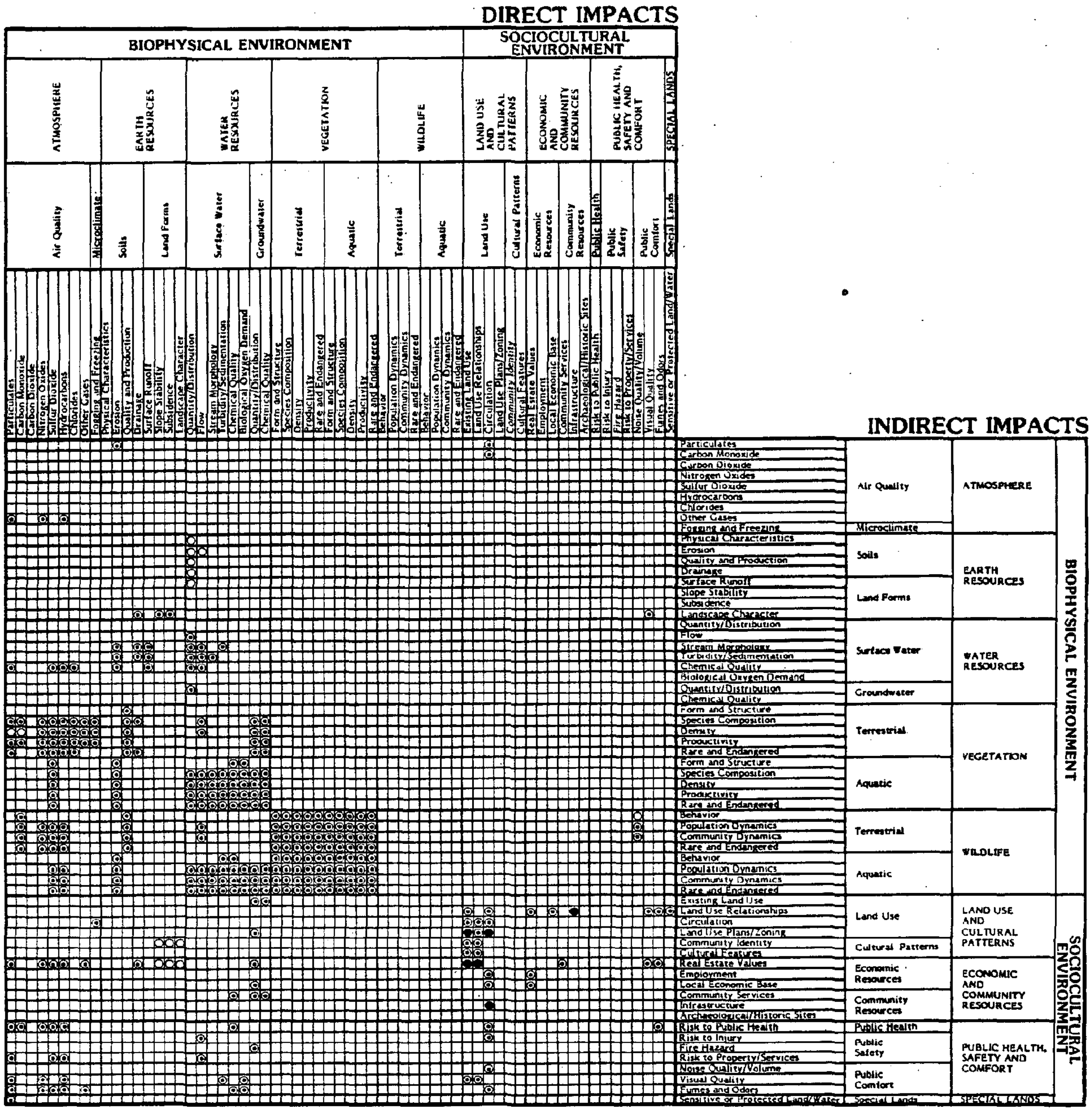
Exhaust emissions from internal combustion (IC) engines contribute significant volumes of nitrogen oxides and hydrocarbons to the atmosphere. It is estimated that 86 percent of the carbon

Figure 13. Impact summary matrix: resource recovery facility



Legend:
- Short-Term Impact
- Long-Term Impact
- Short- and Long-Term Impact

Source: Rogers, Golden & Halpern.



DIRECT IMPACTS
BIOPHYSICAL ENVIRONMENT
SOCIOCULTURAL ENVIRONMENT
ATMOSPHERE
EARTH RESOURCES
WATER RESOURCES
VEGETATION
WILDLIFE
LAND USE AND CULTURAL PATTERNS
ECONOMIC AND COMMUNITY RESOURCES
PUBLIC HEALTH, SAFETY AND COMFORT
SPECIAL LANDS
Air Quality
Microclimate
Soils
Land Forms
Surface Water
Groundwater
Terrestrial
Aquatic
Land Use
Cultural Patterns
Economic Resources
Community Resources
Public Health
Public Safety
Public Comfort
Special Lands
INDIRECT IMPACTS
Particulates
Carbon Monoxide
Carbon Dioxide
Nitrogen Oxides
Sulfur Dioxide
Hydrocarbons
Chlorides
Other Gases
Fogging and Freezing
Physical Characteristics
Erosion
Quality and Production
Drainage
Surface Runoff
Slope Stability
Subsidence
Landscape Character
Quantity/Distribution
Flow
Stream Morphology
Turbidity/Sedimentation
Chemical Quality
Biological Oxygen Demand
Quantity/Distribution
Chemical Quality
Form and Structure
Species Composition
Density
Productivity
Rare and Endangered
Form and Structure
Species Composition
Density
Productivity
Rare and Endangered
Behavior
Population Dynamics
Community Dynamics
Rare and Endangered
Behavior
Population Dynamics
Community Dynamics
Rare and Endangered
Existing Land Use
Land Use Relationships
Circulation
Land Use Plans/Zoning
Community Identity
Cultural Features
Real Estate Values
Employment
Local Economic Base
Community Services
Infrastructure
Archaeological/Historic Sites
Risk to Public Health
Risk to Injury
Fire Hazard
Risk to Property/Services
Noise Quality/Volume
Visual Quality
Fumes and Odors
Sensitive or Protected Land/Water

monoxide originating from mobile sources in the United States can be attributed to IC gasoline vehicles. Diesel engines contribute less than one percent of that pollutant. Other relative contributions include: nitrogen oxides--gasoline engines 67 percent, diesel engines 11 percent; hydrocarbons--gasoline engines 85 percent, diesel engines 0.5 percent. By tempering these estimates with data projecting the number of gasoline- and diesel-powered vehicles included in them (100 million versus 8 million, respectively), it can be seen that while relative nitrogen oxide emissions from both sources are quite similar, diesel engines contribute far less carbon monoxide and hydrocarbons per unit of operation. This is due to the high compression and temperatures inherent in diesel operations and thus, their more efficient combustion.

Heavy construction equipment is notorious for emitting high transient loads of particulates, or smoke. This is due in part to constant load changes during stop-go operations. Overall, the small quantity of emissions coupled with the short-term nature of construction activities will produce very minor and quite localized elevations in certain pollutant concentrations, notably nitrogen oxides. Probably the most substantial mobile source of air pollution associated with facility construction is generated by the labor force vehicles as they enter and leave the facility site. The heaviest concentration of traffic should be along Route 18 and Edgeboro Road. Again, this impact is short-lived and will probably have little adverse effect on ambient carbon monoxide, hydrocarbon, and nitrogen oxide concentrations.

The most significant source of air pollution associated with plant construction will, without doubt, be fugitive dust. Site preparation activities such as excavating, scraping, filling, and compacting generate substantial volumes of dust, which becomes suspended in the atmosphere. Construction of the RRF will involve the alteration of approximately 20 acres of previously disturbed land. Truck traffic moving in and out of the facility will further aggravate this particulate situation. Estimates by the USEPA indicate that suspended dust levels from heavy construction activities approximate 1.2 tons per acre per month of construction activity; thus, 400 to 500 tons of dust may be generated during the 20 months of actual heavy construction. This will change according to different site conditions and construction practices. A description of construction practices and the expected effects on dust levels should be supplied by the applicant.

Earth Resources

The primary impact on soils occurs during site preparation. Equipment operation may compact the land, especially if it is landfill. Surface disturbances such as grading may encourage erosion. It is expected that there will be little or no vegetation on the landfill. Construction will also alter the soil's physical characteristics, but if it is landfill, it is not a true soil and it lacks homogeneity. Man-made land composed of sanitary landfill waste varies widely in composition and physical characteristics, which are dependent on the kind and proportion of disposed wastes, the amount and type of soil cover used, and the degree to which the waste was compacted. The formation of gases and leachate and differential settling rates will severely limit the use of the land. In general, this land is very poor for structural construction and an intensive on-site investigation is necessary if any improvements are to be constructed on it.

As extensive soil borings of the plant construction site are lacking at this time, detailed data on site excavations and fill amounts are not available. Estimates assume that an average 2- to 3-foot backfill will be necessary to bring the surface elevation to an appropriate level; thus, some 40,000 to 60,000 cubic yards of soil will be stripped and replaced by 100,000 to 150,000 cubic yards of material. In addition, approximately 60,000 to 80,000 cubic yards of fill will be needed to provide the proper elevations for the tipping area and drive-up ramp. (These estimates will have to be modified once the contractor presents definite plans.) All fill material used in the construction process should be clean, uncontaminated fill. The final destination of fill material should be supplied by the applicant.

During the process of plant construction, a substantial volume of debris will be generated. This waste will be generally composed of paper, vegetative matter, scrap metals and lumber, concrete, and miscellaneous liquids (oil, hydraulic fluid, etc.). With regard to nonvegetative solid waste, it is estimated that some 40 to 60 tons of solid waste will be generated by the construction work force during the 20-month work regime. Of this waste, recyclable materials (scrap metals, oil, etc.) could be recovered whenever feasible; other components of the waste can be disposed of in the nearby Edgeboro landfill.

Water Resources

Water needed during construction will include potable supplies and water for hydraulic equipment, equipment maintenance, and sanitary needs.

For a construction period of about 20 months, total water needs should be approximately 50,000 to 100,000 gallons per day during peak periods. Most of this water will be used for concrete mixing, building and equipment cleaning, and work force potable supplies. Supply water from the East Brunswick potable water system should be used as a last resort.

Sanitary wastewater needs will most likely be handled by a portable toilet contractor, thus precluding any direct use of public facilities.

In any case, no on-site surface water or groundwater supplies that are used as sources of domestic water will be affected by facility construction. A well point system may be used to extract water from the water table aquifer at the plant site to ensure foundation stability; this water can then be channeled into the perimeter canals that will be needed for receiving storm runoff from the site, without any modifications or withdrawals by construction activities.

The construction of the proposed plant facility will entail the movement of approximately 160,000 to 230,000 cubic yards of fill material at the facility site and along the ingress and egress roadways. Depending on the water table, additional material may be displaced as perimeter canals are constructed; however, the material excavated can be stockpiled alongside these canals for the construction of the site-screening levee. This may facilitate the introduction of sediment and particulate-borne pollutants into perimeter canals and the nearby river. It is expected that sedimentation will be reduced because of the coarse nature (and therefore low erodibility) of the on-site soils and the nearly flat terrain. As the traffic on these roadways will substantially increase during the construction phase, relative sediment contributions from this source may also be expected to increase.

Upon issuance of a "notice to proceed" with construction, activities to reduce subsurface water volumes at the site of the resource recovery plant will begin almost immediately. This will most likely be accomplished through the use of a well point system; however, no dewatering is anticipated for the construction of the perimeter canals and site-screening levee.

Erosion from construction sites yields an effluent that is generally high in hydrocarbon and synthetic waste concentrations; the most notable of these constituents are oils and greases, paving and sealing compounds, pesticides and rodenticides, and cleaning fluids. If prudent erosion control measures are applied, these factors can be substantially mitigated, as the on-site terrain is quite level and consequently less subject to erosion.

Since the facility is to be located near the Raritan River, care must be exercised to ensure separation of all plant-associated water schemes (potable supplies, cooling tower makeup, etc.) from the study area's surface water and groundwater. Aside from this, sedimentation from erosion of exposed soil surfaces and, possibly, the intermixing of surface water with nutrient-enriched aquifer water brought to the surface present the most probable sources of deleterious effects to the Raritan River.

Sedimentation as a result of water and wind erosion may be locally significant in existing drainage ditches. Because of the large size of eroded particles and the sluggish characteristics of drainage ditch flow, most of the particulates entering the ditch via runoff will precipitate and settle near the runoff inlet. Standing water will be monitored and dealt with by the Middlesex County Health and Mosquito Commission.

The detailed soil borings required prior to site preparation have not been made available; consequently, the need for and the volume of subsurface drainage via a well point system are not known. Assuming that some pumping will be required, certain adverse impacts could be incurred if the pumped water were directly discharged to surface water. To prevent the introduction of aquifer water into drainage ditches, well point flows will probably have to be pumped to a stormwater retention or alternative cooling water supply pond, if such provisions are proposed by the contractor. Any disturbances to the salt water gradient will be localized and of little consequence in terms of domestic groundwater, since none is pumped from the area. In any event, well point pumping will be of short duration, and thus any adverse impacts will be relatively short-lived.

There is a possibility that the groundwater under the site is hydraulically connected with the Farrington Sands Outcrop and that leachate originating from the site could impact water withdrawn from the Farrington Sands. This possibility should be further investigated.

Land Use and Cultural Patterns

The construction of the resource recovery plant and associated facilities will necessitate an irreversible commitment of land currently zoned for industrial purposes. The resource recovery facility reportedly will be constructed upon approximately 20 acres within Lot 3.02, Block 834, as noted on the tax map of the Township of East Brunswick. The site is south of the Raritan River and east of the New Jersey Turnpike, adjacent to the existing Edgeboro landfill. Disposal of residues generated by facility construction and operation will occur at the adjacent landfill. Most of the terrain around the 20-acre plant site is highly disturbed land; conversion of this tract to a landscaped and maintained electrical generation plant should represent a positive step in reducing the future need for landfilling, an activity that attracts gulls, flies, and other disease vectors.

At present solid waste generation rates, a typical 20-acre plant site would be consumed for landfilling in a few years. Resource recovery operations will greatly reduce the large and growing need for an expensive, dwindling resource--namely, land--in Middlesex County. It should also be noted that land that has been utilized as a landfill is always a poor site for building because construction will be adversely affected by the potential settlement and subsidence of the ground and the potential migration through the fill of methane gas, an odorless, poisonous, and explosive gas that may accumulate in the basements of buildings.

During construction, a large traffic volume associated with the building of the plant will be noted along certain roadways serving the site. It is anticipated that work force and heavy equipment traffic will use Route 18 and Edgeboro Road to gain access to the site. The land uses abutting Edgeboro Road are composed of manufacturing or undeveloped sites and should therefore be compatible with the expected temporary increases in traffic. Route 18 is a state highway subject to large traffic volume.

The closest residential boundary to the proposed facility is located approximately one-half mile to the southwest along School House Lane.

Economic and Community Resources

Employment. A description of construction operations and manpower should be provided by the contractor in its proposal. A preliminary estimate suggests that as many as 290 persons at one time may be directly involved in the construction of the plant; it is anticipated that all tradesmen will come from regional labor pools, where all the necessary skills are available.

Construction-related work at the site will initially require about 40 people, and within six months, between 80 and 100 people will be employed. These workers will be involved in earth moving, pile driving, and concrete work. During the peak construction employment period, about 120 people will be employed, including boiler workers, ironworkers, pipefitters, electricians, millwrights, and other workers experienced in the construction of industrial buildings. Just prior to operation, the level of employment should be about 20 people. Most of the employees are expected to come from the local area, so any impact should be beneficial.

Archaeological/historical sites. Initial research indicates that no state- or federally recognized cultural, historical, or archaeological sites are located within the study area; consequently, no activity associated with plant construction will inhibit preservation of or access to such an area. This determination is subject to confirmation by NJDEP's State Historic Preservation Office. Clancy Island, the site of the existing landfill, is a local historic area.

Public Health, Safety, and Comfort

Noise quality/volume. Studies of the geometric propagation of sound reveal that, in a general sense, the attenuation of pressure levels as one moves away from the noise source is highly dependent on the magnitude of the noise and the nature of the source (single or multiple, fixed or mobile). Representative noise levels for various types of construction equipment may be taken from table 18.

Table 18. Noise levels (dB) of common construction equipment measured at 50 feet

Front loader	- 79		Crane	- 83	
Backhoe	- 85		Derrick	- 88	
Bulldozer	- 80		Pump	- 76	
Tractor	- 80		Generator	- 78	
Scraper	- 88		Compressor	- 81	
Grader	- 85		Pile driver	- 101	
Truck	- 91		Jack hammer	- 88	
Paver	- 89		Pneumatic tools	- 86	
Concrete mixer	- 82		Saw	- 78	
Concrete pump	- 83		Vibrator	- 76	

Source: Bolt, Beranek, and Newman, 1971.

Conditions indigenous to the study area can greatly influence construction noise levels as perceived in adjacent residential areas. The general site area is located on highly disturbed terrain that has been subjected to landfilling activities for a number of years; thus, noise from incoming and outgoing truck traffic and heavy equipment is commonplace. Moreover, the RRF and nearby residential areas are located within the aircraft approaches of Linden Airport and Newark International Airport. Noise levels in excess of background conditions for residential areas, and similar to construction-related noise levels, thus already occur at the nearest residential area, approximately one-half mile to the southwest. Some information on ambient noise levels for the area is contained in Lewis S. Goodfriend and Associates (1975) and Hintz (1978).

The effects of a representative construction site are as follows. Assume that a background noise level for a residential area approximates 55 decibels (dB). A theoretical increase in pressure level to 75 dB could be incurred by the operation of four trash haul trucks, two dragline cranes, and one bulldozer in a fairly concentrated area of the site. This situation represents actual landfill practices. Initiation of construction and site preparation will mean an influx of similar equipment, in similar numbers. The operation of two bulldozers, two scrapers, and two graders in a spatially concise area could elevate the noise level in the residential subdivision to 69 dB. In another case, where one crane, one compressor, two trucks, and five saws are operating (again, in a localized area), the residential noise level would be elevated to 71 dB. For each construction case, the imparted noise levels fall below those increments currently incurred by landfilling operations. During construction, though, landfilling and construction activities will occur simultaneously; the worst-case noise source for such a situation will probably be due to lines of heavy truck traffic. Assuming a case where nine trucks are equally spaced at 100-foot intervals along the main access road, the noise imparted to residences within one mile is estimated at 49 dB, or approximately 6 dB below background levels; the interaction of noise in that area will probably result in a 1-dB increase over background.

The residential area closest to the proposed facility site is School House Lane, and the nearest houses are situated roughly one-half mile southwest of the plant site. Noise estimates indicate that sound levels imparted to this area by facility construction will be of the same order of magnitude as those already experienced from turnpike traffic and landfilling activities. As construction operations will occur only during daylight hours of the regular work week (7:30 a.m. - 3:30 p.m., Monday - Saturday), noise levels at inappropriate times should not be significantly increased.

Visual quality. The resource recovery facility will visually dominate the view of the site. A typical RRF was shown in figure 1. The proposed improvements should be fairly compatible with the existing visual quality of the site, which is a sanitary landfill. However, the effects of visual changes are subjective and opinions of compatibility may differ.

Construction of Electrical Transmission Lines

The proposed RRF will include a steam turbine generator rated at 13.8 kV, 50,000 kVA at .85 power factor. This unit will be used to convert the steam generated by the burning of solid waste to over 200 million kilowatt hours annually of electricity. The electricity will be sold to Public Service Electric and Gas Company (PSE&G), which has a substation located less than a mile across the Raritan River from the Edgeboro site.

To date, Wheelabrator-Frye's proposal has provided no information concerning the transmission of the electricity to the PSE&G facility, claiming that the responsibility for transmission from the RRF lies with PSE&G. The following discussion, therefore, is based on assumptions concerning the transmission system and will have to be revised when data become available from either Wheelabrator-Frye or PSE&G.

The general impacts of routing electrical transmission lines are summarized in figure 14. Construction activities associated with overhead powerline erection include clearing the right-of-way, installing pole foundations, raising and securing the towers, and stringing the conductors. Land clearing will be quite extensive in the affected areas, as all trees must be removed; this should be done by mechanical means (e.g., bulldozers) rather than chemical means (e.g., herbicides). After the right-of-way is cleared, the tower foundations will be laid, the poles erected, and the transmission hardware placed. These activities will have little or no impact on surrounding terrain, relative to the drastic disturbances incurred by site clearing. Once the project is completed, subsequent right-of-way maintenance will necessitate mowing the understory; small bushes and shrubs are normally permitted. Whenever possible, cable systems should be installed along roadways to minimize impacts. However, the least cost alternative is usually the shortest distance between two points. An alternative to roadway rights-of-way is to excavate for the burial of high-voltage power cables, a more costly approach that may be employed in off-road areas.

The most significant problem in installing cables in off-road areas is the variability in terrain and environmental parameters that may be encountered. Woodlands, marshes, steep slopes, and agricultural land present special construction problems as well as environmental concerns and should be avoided where possible in selecting routes and station locations. Burying cables at a river crossing requires special construction methods because this environment is particularly vulnerable and sensitive to construction impacts.

Construction activities may extend over a considerable distance, since the length of the trench at any one time is usually not restricted. Construction activities for cable routes proceed at rates of 200 or 300 feet per day in favorable conditions, but steep slopes, rock, marshes, and rivers slow progress considerably. A river crossing may take three to four weeks.

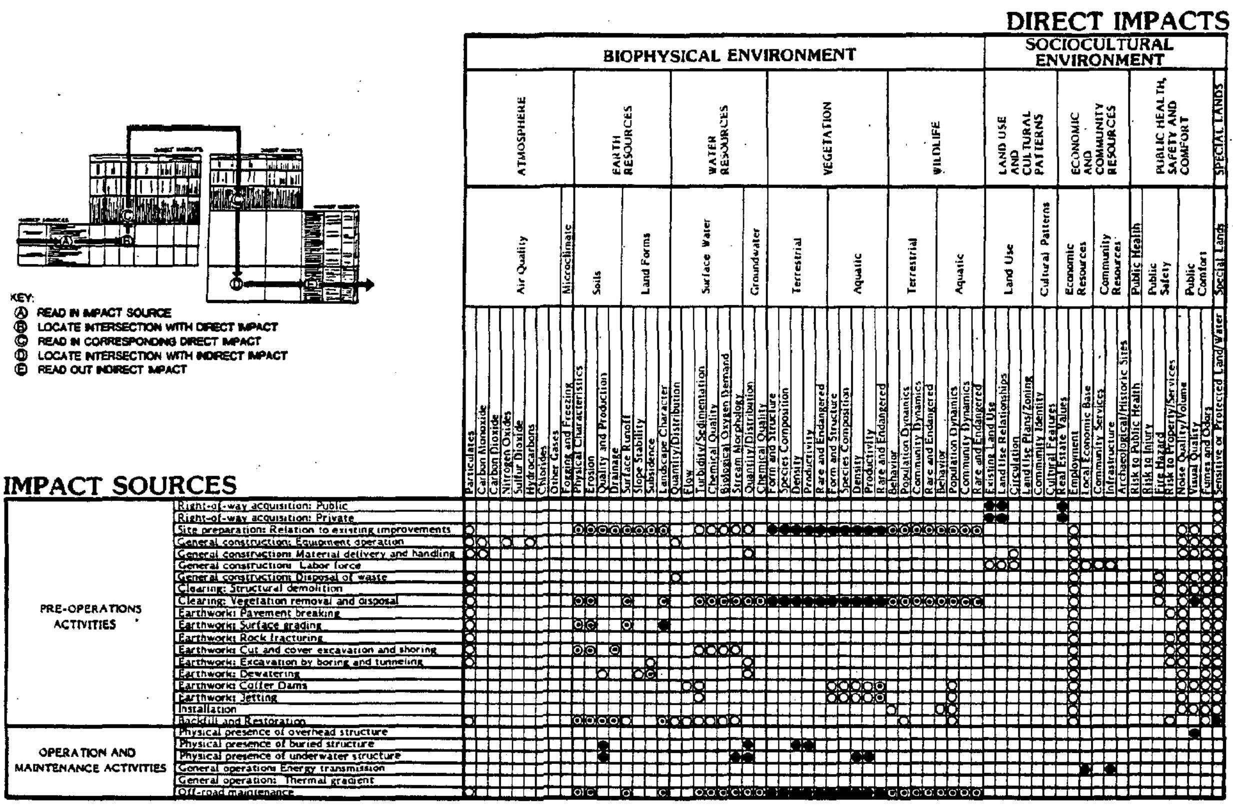
Environmental impacts in off-road areas are as variable as the terrain, land use, and other conditions. Both short-term and long-term impacts can occur from construction. The physical presence of the cable system components and operation and maintenance activities may have long-term impacts. The area of influence of the direct and indirect impacts can range from the immediate right-of-way to down-slope or downstream areas at a considerable distance from the construction activity. In addition, construction and maintenance of transmission lines should be done in a manner that ensures the safety of those who may use the area.

Care must be taken when routing transmission lines across a river because the natural shoreline environment is a highly diverse and valuable habitat for vegetation, wildlife, and man (figure 15). Protection of water quality and aquatic life at a river crossing is particularly difficult because much of the work must be done directly in or on the water. Bottom materials are typically either unconsolidated soils, which are easy to excavate but cause erosion and turbidity problems, or rock, whose excavation requires environmentally damaging blasting.

In the case of cables laid directly on the bottom, excavation is required only to bury the on-shore portion of the cable. When the cable is to be buried, a number of methods are available, as shown in figure 16.

Cut and cover and jetting are the most economical means of below-bottom cable installation and the most frequently used, but they are also the most environmentally disruptive. In order to protect water quality and the aquatic environment where difficult conditions such as soft sediments or swift currents are encountered, special measures such as floating curtains or temporary dikes may be required during construction.

Figure 14. Impact summary matrix: river crossing



Legend:
- Short-Term Impact
- Long-Term Impact
- Short- and Long-Term Impact

Source: Rogers, Golden & Halpern.

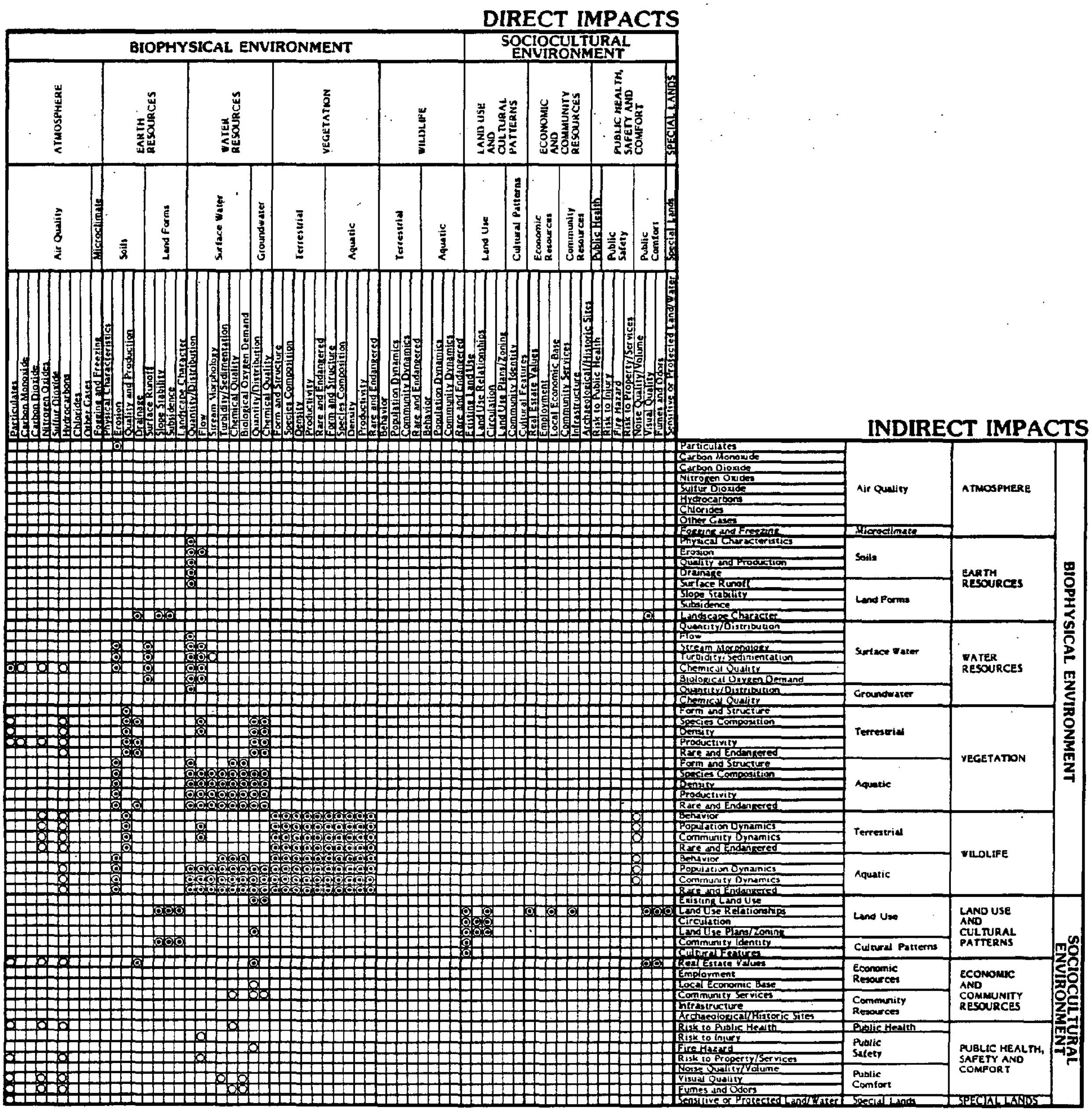
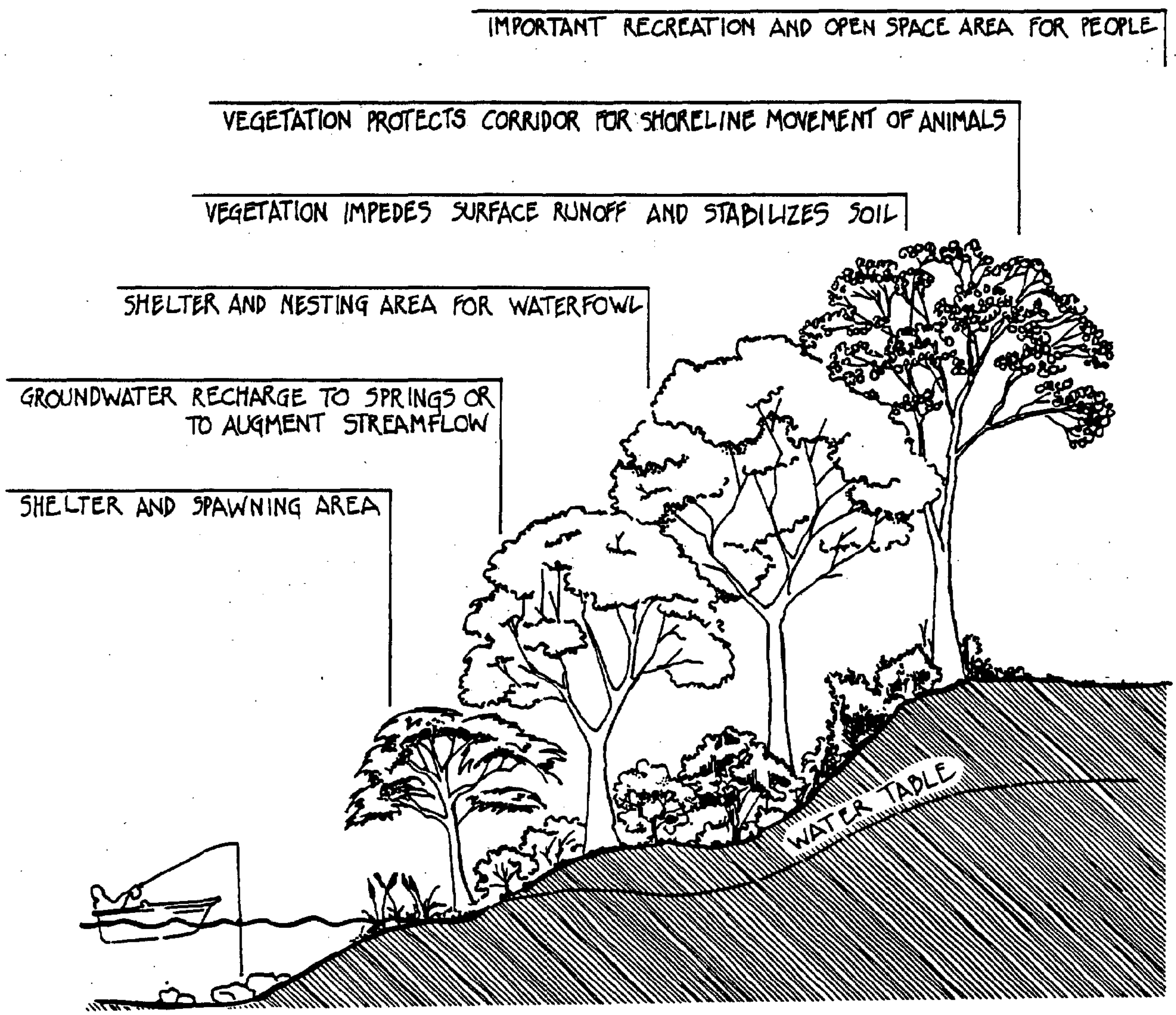
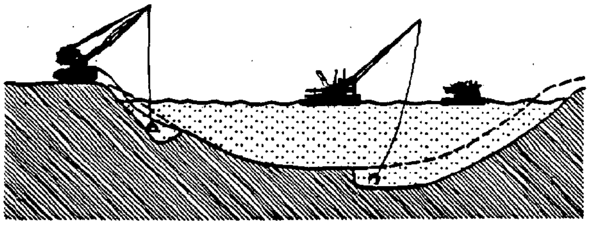

DIRECT IMPACTS
BIOPHYSICAL ENVIRONMENT
SOCIOCULTURAL ENVIRONMENT
ATMOSPHERE
EARTH RESOURCES
WATER RESOURCES
VEGETATION
WILDLIFE
LAND USE AND CULTURAL PATTERNS
ECONOMIC AND COMMUNITY RESOURCES
PUBLIC HEALTH, SAFETY AND COMFORT
SPECIAL LANDS
Air Quality
Microclimate
Soils
Land Forms
Surface Water
Groundwater
Terrestrial
Aquatic
Terrestrial
Aquatic
Land Use
Cultural Patterns
Economic Resources
Community Resources
Public Health
Public Safety
Public Comfort
Special Lands
INDIRECT IMPACTS
Particulates
Carbon Monoxide
Carbon Dioxide
Nitrogen Oxides
Sulfur Dioxide
Hydrocarbons
Chlorides
Other Gases
Fogging and Freezing
Physical Characteristics
Erosion
Quality and Production
Drainage
Surface Runoff
Slope Stability
Subsidence
Landscape Character
Quantity/Distribution
Flow
Stream Morphology
Turbidity/Sedimentation
Chemical Quality
Biological Oxygen Demand
Quantity/Distribution
Chemical Quality
Form and Structure
Species Composition
Density
Productivity
Rare and Endangered
Form and Structure
Species Composition
Density
Productivity
Rare and Endangered
Behavior
Population Dynamics
Community Dynamics
Rare and Endangered
Behavior
Population Dynamics
Community Dynamics
Rare and Endangered
Existing Land Use
Land Use Relationships
Circulation
Land Use Plans/Zoning
Community Identity
Cultural Features
Real Estate Values
Employment
Local Economic Base
Community Services
Infrastructure
Archaeological/Historic Sites
Risk to Public Health
Risk to Injury
Fire Hazard
Risk to Property/Services
Noise Quality/Volume
Visual Quality
Fumes and Odors
Sensitive or Protected Land/Water

Figure 15. Riverside habitats



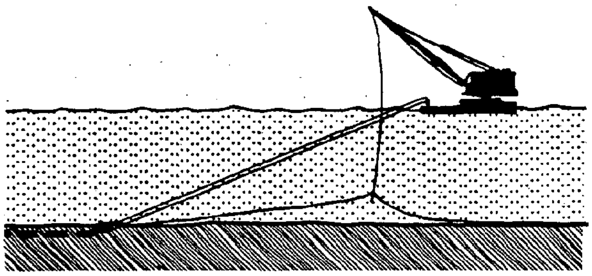
Source: Rogers, Golden & Halpern.

Figure 16. River-crossing cable installation techniques



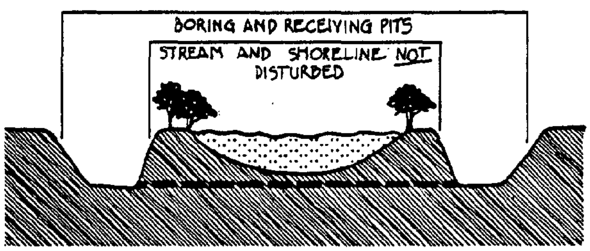
CUT-AND-COVER

WHERE THE CABLE OR PIPE IS PLACED IN A TRENCH WHICH IS THEN BACKFILLED.



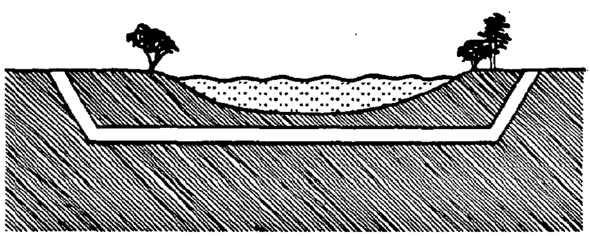
JETTING

WHERE THE CABLE OR PIPE IS PLACED ON THE BOTTOM AND THE UNDERLYING SEDIMENTS ARE LOOSENED, ALLOWING THE CABLE TO SINK BELOW THE SURFACE.



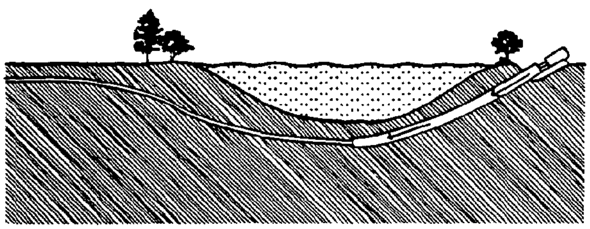
BORING

WHERE PITS ARE DUG ON EACH SIDE OF THE WATERWAY AND A BORING MACHINE IS USED TO DRILL A HOLE FROM ONE PIT, UNDER THE WATER, TO THE OTHER PIT.



TUNNELING

WHERE SHAFTS ARE DUG ON EACH SIDE OF THE WATERWAY AND A SIZABLE TUNNEL IS EXCAVATED BETWEEN THEM. THE CABLES ARE THEN INSTALLED ON RACKS IN THE TUNNEL.



DIRECTIONALLY CONTROLLED HORIZONTAL DRILLING

DIRECTIONAL BORING FOR PIPELINE IS A RELATIVELY NEW TECHNIQUE THAT DEGRADES LESS OF THE ENVIRONMENT, IS QUICKER AND APPEARS TO BE CHEAPER.

Source: Adapted from Electric Power Research Institute and Energy Research and Development Administration, 1975.

Several methods are used for installing the pipe or cable that has been assembled on shore either directly on the bottom or in a trench or jet-dug slot. These methods include:

- o pulling or dragging the cable or pipe from shore to shore
- o floating the cable or pipe from shore to shore and then sinking it into the trench
- o laying the pipe or cable into the trench from a barge

Restoration backfill is often delivered by barge and placed over the cable by clamshell, by a dozer operating on a barge, or by a bottom-dumping barge.

While the construction of underground facilities has the potential for causing unfavorable environmental effects, good construction techniques can minimize or even eliminate most of them.

The aesthetic quality of near-shore areas cannot be fully protected, but the detrimental effects can be limited by using existing rights-of-way or minimizing the width of new rights-of-way, by using such techniques as feathering and screening, and by deflecting entranceways. Major displacement of wildlife will usually occur during construction. Streambanks can and should be stabilized to avoid erosion. Access location, planting, and design can be used to abate noise associated with the operation of stations.

The distance from the proposed RRF to the substation is about 4,500 feet; however, a direct route may not be the best route politically or environmentally. In this case, the important environmental considerations in choosing a transmission line route are as follows:

- o to avoid multiple river crossings
- o where possible, to obtain routing right-of-way along roads
- o to avoid trenching through marsh areas
- o to avoid steep slopes

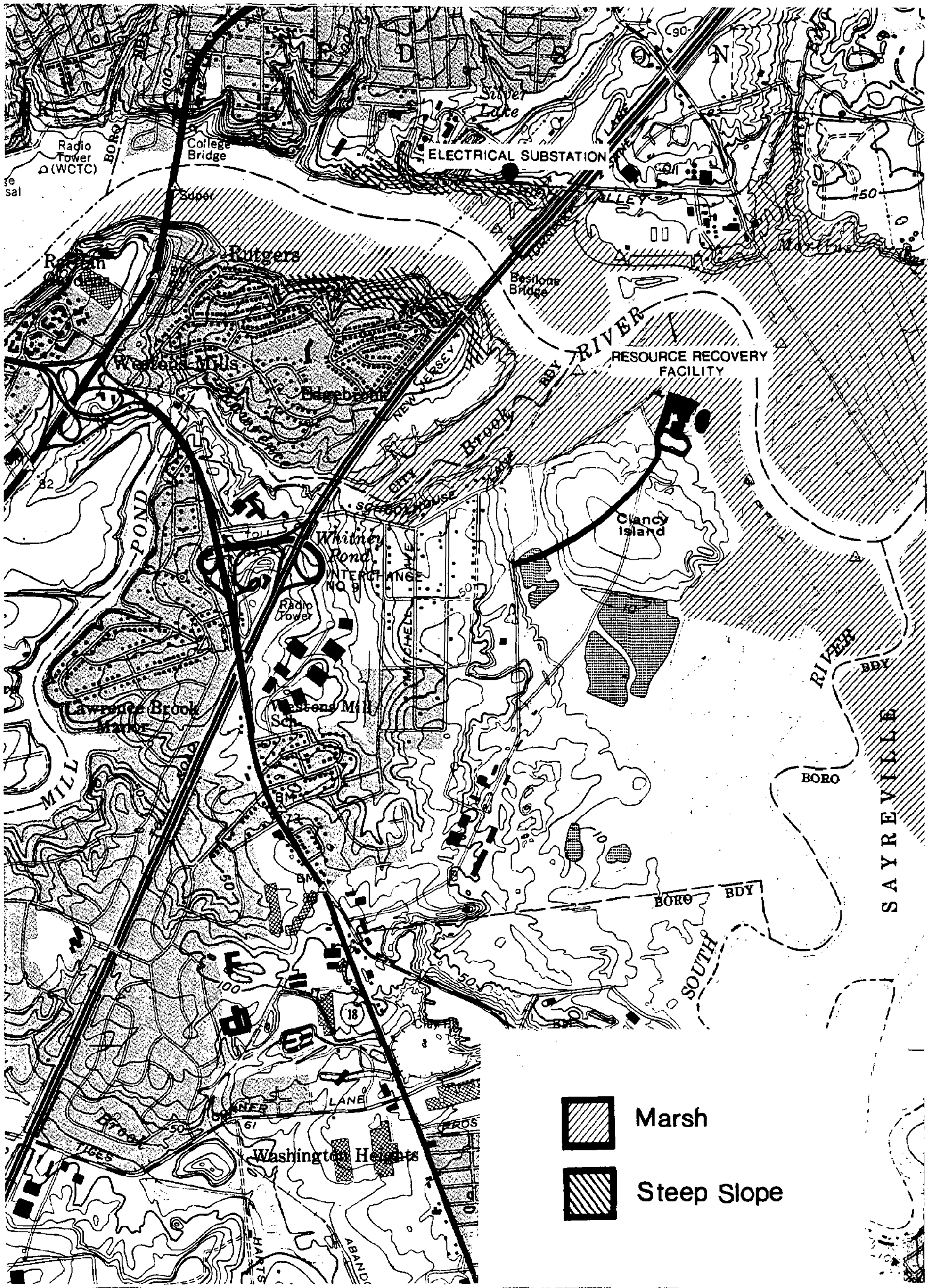
Figure 17 is a map showing marshlands and areas of steep slopes between the proposed RRF and the electrical substation.

Operation and Maintenance Activities

Atmosphere

Air Quality. Compliance with the Clean Air Act, and in particular with the 1977 amendments to it, must be considered as a first-order priority in planning for an RRF. Regulations under the

Figure 17. Steep slopes and marshlands between proposed resource recovery facility and the closest electrical substation



Source: U.S. Geological Survey, 1970, and Rogers, Golden & Halpern.

act (Sec. 4, P.L. 91-604, 84 Stat. 1679) may influence the plant size and its process design and determine when construction can begin. The Clean Air Act requires examination of the RRF's emission rates of certain gases, the area's existing air quality, and the area's predicted air quality when the facility is operational. Table 19 presents calculations for the proposed RRF's emission rates of gases of concern. Table 20 is a summary of these rates.

National Ambient Air Quality Standards. Areas in which a pollutant exceeds these standards are termed non-attainment areas. The entire state of New Jersey is a primary non-attainment area for ozone. Portions of Middlesex, Union, Essex, and Hudson counties and the cities of Camden, Jersey City, and Bridgeton are secondary non-attainment areas for total suspended particulates. Sixteen business districts are confirmed primary non-attainment areas for carbon monoxide and 75 other areas are suspected non-attainment areas. Non-attainment areas for lead have not been identified, although monitoring for this pollutant will be conducted at 20 of the 100 TSP monitoring sites. In a non-attainment area, no new major source of the pollutant can be constructed unless it incorporates pollution control technology that will provide the lowest achievable emission rate for the pollutant and, if necessary, obtains pollution offsets from other sources in the area.

All new sources of pollutants must demonstrate that they do not contravene the ambient air quality standards. Any source violating the NAAQS for a given pollutant must execute a dispersion model, which would factor in local winds, stack height, source strength, temperature, time of year, inversion strength, etc. and generate a prediction of the levels of concentration of that pollutant as a function of distance from source. Areas of compliance and noncompliance with ambient air quality standards would then be identified.

Hydrocarbons are emitted to the atmosphere from an RRF under conditions of poor combustion and incomplete mixing of secondary air with the gases rising from the grate in the firebox. They are difficult to measure because they are composed of a number of diverse and complex compounds. In addition, hydrocarbon emissions from automotive and petrochemical sources in eastern New Jersey would probably be indistinguishable from the measurements from an RRF. Nonetheless, values found in the literature that reflect emissions from typical U.S. municipal incinerators range from 0.3 to 2.7 lbs of hydrocarbons per ton of refuse. Most of these incinerators, however, are no longer state-of-the-art. In the Wheelabrator-Frye system, secondary air is introduced above the grates near the arch of the throat area to cause turbulent mixing and more complete combustion of hydrocarbons. West German studies indicate that values in the range of 10-40 parts per million (ppm) of hydrocarbons may be expected from modern waterwall incineration systems. For the proposed RRF at Edgeboro, 0.3 lbs. of hydrocarbons per ton of refuse, which is approximately equal to 40 ppm by volume, can be used for planning purposes. As shown in table 19, this results in an estimated emission rate of 59 STPY.

Table 19. Calculations of approximate annual emission rates from the proposed resource recovery facility

Hydrocarbons

Assume 40 ppm in flue gas, or about .3 lb hydrocarbons per ton of refuse

$.80 \times 2 \times 670 \text{ STPD} \times 365 \text{ days/yr} \times .3\frac{\text{lb}}{\text{ST}} \times \frac{1 \text{ ST}}{2{,}000 \text{ lb}}$ 59 STPY

Sulfur dioxide

Assume average sulfur content of .10% by weight of refuse and that 50% of sulfur will be returned in bottom ash; thus average flue gas concentration of 67 ppm, or about 2 lb/ST of refuse

$.80 \times 2 \times 670 \text{ STPD} \times 365 \text{ days/yr} \times 2\frac{\text{lb}}{\text{ST}} \times \frac{1 \text{ ST}}{2{,}000 \text{ lb}}$ 391 STPY

Nitrogen oxides

Assume 140 ppm in flue gas, or about 3 lb/ST

$.80 \times 2\ 670 \text{ STPD} \times 365 \text{ days/yr} \times 3\frac{\text{lb}}{\text{ST}} \times \frac{1 \text{ ST}}{2{,}000 \text{ lb}}$ 587 STPY

Carbon monoxide

Assume 170 ppm in flue gas, or 2.2 lb/ST

$.80 \times 2\ 670 \text{ STPD} \times 365 \text{ days/yr} \times 2.2\frac{\text{lb}}{\text{ST}} \times \frac{1 \text{ ST}}{2{,}000 \text{ lb}}$ 430 STPY

Hydrochloric acid

Assume 250 ppm in the flue gas, or 4.2 lb/ST

$.80 \times 2 \times 670 \text{ STPD} \times 365 \text{ days/yr} \times 4.2\frac{\text{lb}}{\text{ST}} \times \frac{1 \text{ ST}}{2{,}000 \text{ lb}}$ 822 STPY

Fluorides

Assume 13 ppm in flue gas, or .12 lb/St

$.80 \times 2 \times 670 \text{ STPD} \times 365 \text{ days/yr} \times .12\frac{\text{lb}}{\text{ST}} \times \frac{1 \text{ ST}}{2{,}000 \text{ lb}}$ 23 STPY

Lead

Ultimate lead emissions will depend on efficiency of electrostatic precipitators; literature sources suggest .017 lb/S

$.80 \times 2 \times 670 \text{ STPD} \times 365 \text{ days/yr} \times .017\frac{\text{lb}}{\text{ST}} \times \frac{1 \text{ ST}}{2{,}000 \text{ lb}}$ 3.3 STPY

Table 19. (cont'd)

Particulates

Assume 3,500 $\frac{DSCFM}{STPH}$ is the flue gas rate firing at 100% excess air (literature sources vary from 3,000 to 4,000 $\frac{DSCFM}{STPH}$). $\frac{.015\ grain}{DSCF}$ is the maximum particulate emission rate using electrostatic precipitators as referenced by Wheelabrator-Frye.

$$.80 \times 2 \times 670\ STPD \times 365\ days/yr \times .015 \frac{grain}{DSCF} \times \frac{1\ lb}{7{,}000\ grain} \times 3{,}500 \frac{DSCFM}{STPH}$$

$$60 \frac{min}{hr} \times \frac{1\ lb}{2{,}000\ ton} = 88\ STPY$$

Source: Quantum Associates, 1981.

Notes:

.80	= average annual capacity factor of RRF (based on past performance)
2	= number of furnaces
670 STPD	= continuous refuse burning rate per unit in short tons per day
ST	= short ton
STPY	= short tons per year
STPH	= short tons per hour
DSCFM	= dry standard cubic foot per minute
ppm	= parts per million

Table 20. Summary of calculations of approximate annual emission rates (STPY)

Hydrocarbons	59
Sulfur dioxide	391
Nitrogen oxides	587
Carbon monoxide	430
Hydrochloric acid	822
Fluorides	23
Lead	3.3
Particulates	88

Source: Table 19.

Since the entire state of New Jersey is a non-attainment area for ozone, a dispersion model for hydrocarbon emissions from the RRF would be necessary. In this case, the dispersion model likely would be utilized in reverse. That is, it would be assumed that the final concentration at some distance downwind would meet the ambient air quality standards and the model would be used to determine the source strength. If this number should become significant, then the NJDEP may require additional treatment of the hydrocarbon stack emissions and/or consider an offset with other emission sources. However, New Jersey offset regulations (NJAC 7:27-18.5) indicate that offset requirements can be postponed in the case of a significant emission increase from an RRF. An applicant for an emission offset postponement must demonstrate that emission offsets are not immediately available and that when emission offsets become available, they will be secured without delay.

Although the Edgeboro site is not within a non-attainment area for total suspended particulates, parts of Middlesex County are, and it will be necessary to determine if TSP produced by the RRF will have an adverse effect on ambient air quality within the non-attainment area. Wheelabrator-Frye projects that TSP emissions will not exceed 0.015 grains per standard cubic foot on a dry basis when the gas volume is adjusted to 12 percent carbon dioxide. This would result in approximately 88 STPY of particulates (a large portion of which will be in the low micron or respirable range) emitted every year into the environment downwind from Edgeboro (table 18). This is a substantial amount, and it may be far in excess of any offsets that result from reduced fugitive emissions because of reductions in landfilling due to RRF construction. Furthermore, Wheelabrator-Frye's claim that TSP emissions will not exceed 0.015 grains per dry standard cubic foot has not yet been demonstrated. This emission rate may be difficult to achieve with only electrostatic precipitators as the control device. If there is a possibility that TSP emissions will impact the non-attainment area for TSP, then the development of a dispersion model will be necessary and procedures similar to those outlined above for hydrocarbon emissions may have to be employed.

The area centered around the intersection of Route 18/Edgeboro Road is suspected to have high concentrations of carbon monoxide and a study to determine carbon monoxide levels is currently in progress. Should the area be determined to be a carbon monoxide non-attainment area, then procedures similar to those outlined above for hydrocarbons may be applied to carbon monoxide emissions from the RRF. As shown in table 20, estimated carbon monoxide emissions from the RRF are 430 STPY.

Prevention of Significant Deterioration. The Middlesex County Board of Chosen Freeholders, through the Planning Board and its Air Quality Planning Committee, assists in the PSD permitting process carried out by USEPA and NJDEP. The proposed Edgeboro RRF will be designed to charge up to 1,340 STPD, and a comparison of tables 8 and 20 indicates that the 250-STPY level is expected to be exceeded for three of the regulated pollutants--carbon monoxide, nitrogen oxides, and sulfur dioxide. Therefore, the proposed RRF is expected to undergo a PSD review.

The PSD review requires analysis for each pollutant that exceeds the 100-STPY limit for one of the identified 28 industrial sources or the 250-STPY limit for other new major sources. This analysis includes (1) best available control technology analysis, (2) air quality impact analysis, and (3) additional impact analysis.

As noted in Chapter 2, the best available control technology is determined by the reviewing authority on a case-by-case basis. It must be installed to reduce emissions for each significant pollutant identified by the authority. To date, only total suspended particulates have been identified as significant pollutants that must meet the best available control technology standard.

The air quality impact analysis must be conducted for each regulated pollutant subject to PSD review that is expected to be emitted from, or whose emission is expected to significantly increase in conjunction with, the proposed RRF's operation. The air quality analysis will require continuous ambient air quality monitoring data on the proposed site for the regulated pollutants which the plant would emit in significant amounts. Continuous monitoring must occur for at least a year before the application is reviewed, although this period may be reduced to not less than four months by the EPA's district administrator. The sponsors of the RRF must demonstrate, through the use of the baseline monitoring and air quality analysis, which may include dispersion modeling, that pollutant emissions will not adversely affect either non-attainment areas established by NAAQS or federally designated class 1 air quality areas.

The last part of the PSD review is an additional impact analysis for each pollutant subject to review. This analysis will determine the air pollution impacts on soils, vegetation, and visibility. Included in this analysis are the air quality impacts due to associated commercial, residential, and industrial growth and secondary emissions. Once the source is in operation, emissions must be periodically monitored to ensure that they have remained within the specifications.

New Source Performance Standards. Most RRFs are covered as incinerators. The federal regulations specify that the acceptable maximum TSP emission rate of each incinerator unit capable of charging more than 50 tons of municipal waste in a 24-hour day is 0.08 grains per dry standard cubic foot. This standard is being revised, and RRFs will be covered under the new standard of performance that will apply to waste-fired boilers. Neither fossil fuel nor wood residues are proposed to be used in Wheelabrator-Frye's RRF. Therefore, it will not be necessary to meet the standards of performance for fossil-fuel steam generators.

National Emission Standards for Hazardous Air Pollutants. The emission limit for beryllium is 10 grams per 24-hour period, and for mercury it is 3,200 grams per 24-hour period. NESHAP requirements for these chemicals will apply to the proposed RRF.

NJDEP air quality permitting regulations. According to the state-of-the-art pollution technology regulations being developed by NJDEP, halogenated acids emissions are restricted to 50 ppm or 90 percent emission control (more stringent than 50 ppm). This standard could pose problems for the proposed RRF. Its hydrochloric acid emissions are estimated at 822 STPY, making hydrochloric acid the most numerically significant pollutant emitted. However, as noted in Chapter 2, West German emission control technology has reduced hydrochloric acid emissions by more than 90 percent. NJDEP permit regulations for municipal incinerators state that heavy metal and hydrocarbon emissions must also be reviewed on a case-by-case basis.

In summary, the proposed RRF will have to meet NAAQS requirements for hydrocarbon emissions because of the primary ozone non-attainment designation for New Jersey. It may also be required to meet NAAQS for total suspended particulates if it is shown that these emissions will impact the TSP secondary non-attainment area to the northeast of the proposed site. PSD review requirements will probably be required for three pollutants. Under PSD, the best available control technology requirement will apply to TSP emissions; its applicability to other significant pollutants from RRFs must be made by the reviewing authority. NSPS regulations for TSP apply to the RRF, and sulfur dioxide and nitrogen oxides standards may also apply if more than 250 million BTU per hour of fossil fuel are burned, although this is not a proposed fuel for the RRF. NESHAP requirements for beryllium and mercury will also be applicable. Finally, NJDEP permitting regulations will apply state-of-the-art standards, which are likely to include standards for the emissions of TSP, nitrogen oxides, halogenated acids, hydrocarbons, and heavy metals.

Microclimate. The potential for fogging from cooling tower emissions needs to be evaluated by analyzing the saturation deficit with respect to ambient meteorologic conditions and cooling tower emission specifications. This potential is best measured at the stack outlet, and fogging in outlying areas is expected to decrease as a function of the ambient saturation deficit. In general, fogging will most likely occur more frequently during the winter.

Because of the site's proximity to the New Jersey Turnpike, local meteorologic conditions need to be carefully scrutinized in order to determine whether fog might drift across the Turnpike, reducing visibility and/or creating icing conditions. A check with the utility plant northwest of the Turnpike might provide some insights into this potential problem.

The dispersion and concentration of mechanically entrained water droplets may be considered significant in that the droplets will almost certainly contain the chemical constituents of the cooling tower make-up supply.

Drift is the portion of the cooling system flow stream that is entrained in the forced air stream in the tower and carried out of the tower in the rising plume. Usually, unlike the evaporated portion of the plume drift has physical and chemical characteristics the same as those of the cooling system water. The drift discharge flow rate may approach 20 to 40 gallons per minute (gpm), depending on the size of the cooling system. The droplets within the drift stream will probably be deposited on the terrain around the stack at radii varying with meteorologic conditions.

Earth Resources

Regardless of the type of technology ultimately employed, any RRF requires the availability of a landfill. Resource recovery will, however, dramatically reduce the need for landfill space.

The major parameter which determines the capacity of a given landfill is volume. The mass burning technology proposed for the Edgeboro RRF is extremely efficient in the degree to which volume reduction can be effected.

Well-run European facilities accomplish volume reduction on the order of 95 percent of the incoming raw waste stream. Additional volume reduction can be accomplished by postcombustion materials recovery.

Beyond this general and mostly introductory discussion, the proposal should be examined in order to make more definitive determinations of the potential for volume reduction. Likewise, the particular standards for burnout should be further investigated.

The better European grate systems (the grate is the device on which waste combustion takes place) are generally designed to comply with the following standards:

- o The amount of unburned carbon remaining in the residue must not exceed 5 percent by weight.

- The amount of remaining putrescibles in the residue must not exceed 0.3 percent by weight.

There is no reason why the RRF proposed for Edgeboro cannot provide the same degree of burnout. The RRF's design must be checked, however, and such standards must be specified in the resulting operating permit.

Compared to the current methods of landfilling at Edgeboro--i.e., raw waste landfilling--the residue from the RRF will be essentially inert, preventing the release of biologically active leachates and the formation of noxious gases, especially methane. In addition, there will be a reduction in fugitive emissions because the residue from the RRF will be deposited in the wet state that is the result of water quenching.

It should be noted that even residue resulting from mass burning is initially not totally inert. A great deal of investigation has been done in Europe, most notably in Denmark and Germany, to characterize the leachate profile of such residues. While these studies continue, it is already clear that these leachates are substantially less than those from the same amount of raw waste landfilled. Furthermore, their release is limited to the initial period, which can be expressed in days. Therefore, leachate from processed waste can be more effectively treated than leachate from raw waste.

The source of the leachate of most concern is flyash, which accounts, fortunately, for only about 10 percent of total ash. As a precautionary measure, it is recommended that flyash be collected separately from bottom ash.

It is even conceivable that at some point in the future the USEPA, or its successor state agencies, may rule flyash to be a hazardous substance subject to special disposal provisions. In that case two alternative approaches need to be considered:

- flyash disposal in special landfills permitted for hazardous waste disposal

- installation of impermeable liners, together with leachate collection and treatment systems

The latter course of action has been chosen for the RRF in Harrisburg, Pennsylvania. One solution might be to line only the part of the landfill to be reserved specifically for flyash disposal.

In general, the adverse impacts associated with the raw waste previously landfilled at Edgeboro center on the possible contamination of a critical hydrologic unit through leachate infiltration. Depending on local conditions, including the hydraulic characteristics of aquifer systems, leachate plumes mav continue to impact groundwater quality long after the termination of putrescible waste disposal. Short-term improvements in aquifer water quality, therefore, are not expected following initial plant start-up; rather, gradual improvement, compounding with increased time, is more likely.

Raw waste bypassing and nonprocessible waste disposal are two other aspects of landfilling.

The RRF's plant configuration and operating strategies need to be examined in order to comment on the need for raw waste bypassing under emergency conditions. The determining factor will simply be cost economics.

Relative to a given local waste stream, the plant's nameplate capacity can be oversized, and this, combined with a high degree of equipment redundancy, would virtually ensure that raw waste will never be bypassed to the landfill, even under the most adverse circumstances. Furthermore, the possibility of bypassing is reduced by an adequately designed refuse storage pit and by the operator's understanding of effective pit management. If properly managed, overloads can be safely stockpiled for several days. At present it is not clear whether or not Wheelabrator-Frye intends to provide such a refuse storage pit.

Although it is not anticipated, in the event of a complete shutdown, waste originating outside the county that was to be transported to the Edgeboro RRF can possibly be diverted to other disposal sites, provided that no put-or-pay contracts are involved.

For nonprocessible wastes, such as demolition debris, continued landfilling is the onlv realistic disposal method. Thus, adequate space has to be alloted for this purpose. Bulky wastes, such as furniture, timber, and packaging materials, can be processed in the RRF if size reduction equipment is installed. The European plants generally provide hydraulic shears for this purpose, while shredders, because of their explosive hazards, are the exception.

Water Resources

It is estimated that the total effluent flow, composed of sanitary and process blowdown waste, will average 250-350 gpm. Chemicals are associated with an RRF, especially with the boiler and cooling systems, where corrosion inhibitors and antifouling agents will be collected in the blowdowns. These waste streams (with an average combined flow on the order of 100-300 gpm) will probably be augmented by flow from the demineralizer backwash (average flow of 4-8 gpm).

This wastewater may be temporarily stored in a holding tank, monitored, and stabilized for pH, and, with the exception of a 10- to 20-gpm flow diverted as a residue quench supply, eventually discharged to the nearby sanitary sewer system. All domestic wastewater and effluent from tipping area washdown should also be routed to the holding tank for stabilization and discharge. At no time should process or sanitary wastewater be discharged to surface water or groundwater.

Water uses include potable and sanitary uses and boiler feed water makeup. Cooling towers experience evaporative losses, especially during the summer, so that substantial amounts of makeup water will be required. This water may be supplied by the East Brunswick water system at an average rate of 50-100 gpm. Typically, an estimated 40-60 gpm of this flow will be used as boiler feed water makeup with the remainder used for resident potable and sanitary needs. At such a low flow rate no adverse impacts on local water supplies (which are obtained far away from the site) would normally be expected. However, it should be noted that the East Brunswick water system has been identified as having potential problems maintaining an adequate water supply.

Other possible sources for makeup water may be from non-potable treated wastewater effluent, if any can be identified nearby, or it may be withdrawn from nearby stormwater retention ponds, if there are any. Another approach might be to withdraw water from the Raritan River and treat it prior to use as makeup water. In order to conserve overall water consumption in the plant, cooling tower blowdown should either be further utilized (as residue quench water) and ultimately discharged into the domestic sewer line, or mechanically entrained or evaporated to the atmosphere.

The withdrawal of brackish water from the Raritan River may be difficult at times because of reduced river flow. Presently, New Jersey is required to maintain a flow of 90 million gallons per day (mgd) at Bound Brook. However, during a drought emergency, the minimum flow figure does not need to be enforced, and the state can reduce the flow as much as necessary. The state will attempt to maintain a flow of 70 mgd under drought emergency conditions. Under these conditions stormwater runoff would not be available, so an alternative makeup water supply would be necessary.

All wastewater should be discharged to the sanitary sewer system, subject to pretreatment regulations and toxics prohibitions. Wastewater should not be discharged into leachate stabilization ponds at the Edgeboro landfill after treatment, since biological activity in the ponds could be seriously disturbed.

Following prolonged periods of excessive rainfall, the water level of a typical retention pond may approach an overflow condition; to prevent spillage and subsequent flooding (and thereby retain all stormwater on site), pumping the excess to an alternative location should be considered. For the sake of keeping the overall drainage design properly oriented and closed to adjacent surface waters, the diversion of such excess flows to the cooling tower as an auxiliary makeup supply should be considered. Once the optimum pond water level is achieved, cooling water withdrawals should cease.

It is hoped that only very limited water withdrawals (i.e., only to regulate pond levels) will be required. Therefore, it is anticipated that entrainment, impingement, and entrapment will not severely stress the functional aspects of the pond ecosystem. Since algal concentrations and vegetative debris within ponds are typically substantial, sophisticated screens, representing the best available technology, should be installed at the cooling water intake, thereby minimizing the negative environmental impact.

A hypothetical retention pond may be a closed, very shallow surficial water body. It can be stated that circulation within such a pond, while limited, probably occurs in direct response to wind conditions and, to a lesser degree, groundwater flow; thermal stratification is not probable, and thus seasonal mixing is not a likely factor. The limited withdrawals of water proposed will produce short-term modifications of an already restricted circulation. At an estimated pumping rate of 100 to 300 gpm, the impact of altered flow will probably prevail through most of the pond. Turbidity and sedimentation from scouring will be confined to the immediate vicinity of the intake structure. However, given that the withdrawals will occur only when water levels are excessive, overall long-term alterations in ecologic schemes due to such phenomena are judged to be of minor importance. This discussion needs to be verified, however, once the actual details of the proposal become available.

Since utilization of pond water will not occur with any degree of regularity, it is reasonable to assume that no withdrawals will occur for months at a time. Thus, the relative dependence of the pond ecosystem on plant operation will be basically nonexistent.

As mentioned earlier, the possibility that the groundwater under the site is hydraulically connected with the groundwater in the Farrington Sands Outcrop should be investigated. Information on expected groundwater effects should be supplied by the applicant.

Wildlife

It is apparent that the reduction of landfill disposal of solid waste will constrain to some extent the proliferation of dependent scavengers, primarily the seagulls. As large populations of these animals derive most of their sustenance from waste at the site and nearby at Edgeboro, the fate of a large number of organisms is uncertain. Since it is not probable that alternative food supplies are readily available in the surrounding river area, a reduction in species population can be expected.

Other wildlife may also be disturbed, although the lack of information precludes any analysis at this time. Information on wildlife may be requested from the applicant.

Public Health, Safety, and Comfort

Noise quality/volume. The loudest exposed, steady-state noise source associated with plant operation is the turbine generator, with an expected sound pressure level of 85 dB (measured at the unit). For a similar application, it was estimated that such a unit could impart a noise level of 40-50 dB to the nearest residences. If one can assume a residential area background level of 55 dB, then it can be predicted that, conservatively speaking, an increase of at most 1-2 dB may result. Good engineering practice would dictate that the turbogenerator be enclosed in louvered panels, and some trees can be planted to buffer the noise source. Consequently, further attenuation is highly probable.

In addition to steady-state noise sources, there is some concern over intermittent sources, such as vent valves for high-pressure steam and compressed air. These sources can be better evaluated once Wheelabrator-Frye presents its proposal with the pertinent details.

Visual quality. Architectural masking can be required to enhance aesthetic appeal; moreover, on-site roadways and plant grounds will be landscaped. Some individuals will always maintain that any industrial facility is unsightly; however, the alternative choice (i.e., continued landfilling of solid waste) offers vistas of seagulls and garbage mounds. What constitutes acceptable visual quality is a subjective judgment.

Maintenance of Electrical Transmission Lines

Since much of the area surrounding the proposed RRF consists of marshland, repeated excavations for cable repair and/or replacement are undesirable; however, the possibility of such excavations cannot be ruled out during the life of the project.

It is recommended that all transmission line rights-of-way be maintained by mowing. The use of herbicides or fire, which is illegal, is discouraged. Allowed vegetation in the clear zones is limited to low bushes and shrubs. As is typical for the geographic area, cleared areas will probably be revegetated by scrub pines and oaks. Indeed, these trees have been observed to form low, dense thickets under and over existing transmission lines in the study area. Where the proposed transmission line transects disturbed vegetation areas, no substantial long-term changes in the biota are expected.

Obviously, the transmission line will not be visible at nearby residences if the underground option is selected. Again, though, the proposed route must be carefully examined in terms of relevant socioeconomic and environmental parameters in order to judge its soundness. If it is decided that the river crossing is to be accomplished by utilizing existing structures of the New Jersey Turnpike, appropriate discussions should be initiated with the Turnpike Authority in order to review the conditions for such use. Further assessment of the impact of the maintenance of electrical transmission lines can be accomplished once a route is proposed.

Transport of Solid Waste

The potential impacts of trucking or barging wastes are presented in the impact summary matrices for these transportation systems, figures 18 and 19. At present, no site(s) have been selected for the transfer station(s), nor have roads to be improved and dredging disposal sites been identified. Therefore, the impacts of transport on most of the environmental components cannot be discussed at a level of detail greater than what is presented already in Chapter 2. Three exceptions are air quality and, under Public Health, Safety, and Comfort, risk to public health and visual quality. Discussions of these environmental components follow.

Atmosphere

Air quality. Like the point source of the RRF stack, the trucks transporting solid waste to the site will constitute a major source of air pollution when the proposed resource recovery facility becomes operational. Other sources listed in the impact summary matrices are minor compared to these two. The regulatory framework for each of these major sources is different. Various permits to construct and operate the RRF as a point source must be obtained by the operator, as discussed in the section on the impacts of the RRF. The vehicles, on the other hand, are regulated not in the aggregate but as individual vehicles, although their combined emissions may be similar in magnitude to those of the RRF point source. In the section that follows, estimates will be made of solid waste vehicle emissions, and various comparisons will be made of these air pollutant loads with loads from other mobile sources.

<u>Regional loads of air pollutants due to solid waste vehicles in transit to the Edgeboro RRF landfill</u>. The total daily and annual loads of carbon monoxide, hydrocarbons, and nitrogen oxides from all vehicles (trucks and barges) transporting solid waste to the Edgeboro RRF/landfill in 1990 can be estimated based on solid waste tonnage projections (see Chapter 4) and a series of assumptions concerning air pollutant emission rates. These assumptions are listed in table 21.

Emissions from trucks and barges in transit from each municipality are calculated by multiplying round-trip distance by trips per day by pollutant emission rates. The total for each pollutant for all of Middlesex County is determined by summing the daily emission rates of all municipalities.

The truck and barge alternatives can be compared with respect to air pollutant production. The results of these calculations for

Table 21. Estimated air pollutant emission rates for trucks and barge towboats

Truck (heavy duty diesel)	
Capacity	5 tons
Emission rate (g/mi)	
Carbon monoxide	28.7
Hydrocarbons	4.6
Nitrogen oxides	20.9
Trips per day	
(TPD/5 tons per trip)	see table 33
Trip distance	see table 35
Barge towboat (2,500 HP diesel; low speed)	
Capacity	900 tons per barge towed
Emission rate (lbs/1,000 gal fuel)	
Carbon monoxide	59.8
Hydrocarbons	22.6
Nitrogen oxides	419.6
Fuel consumption (gpd)	367

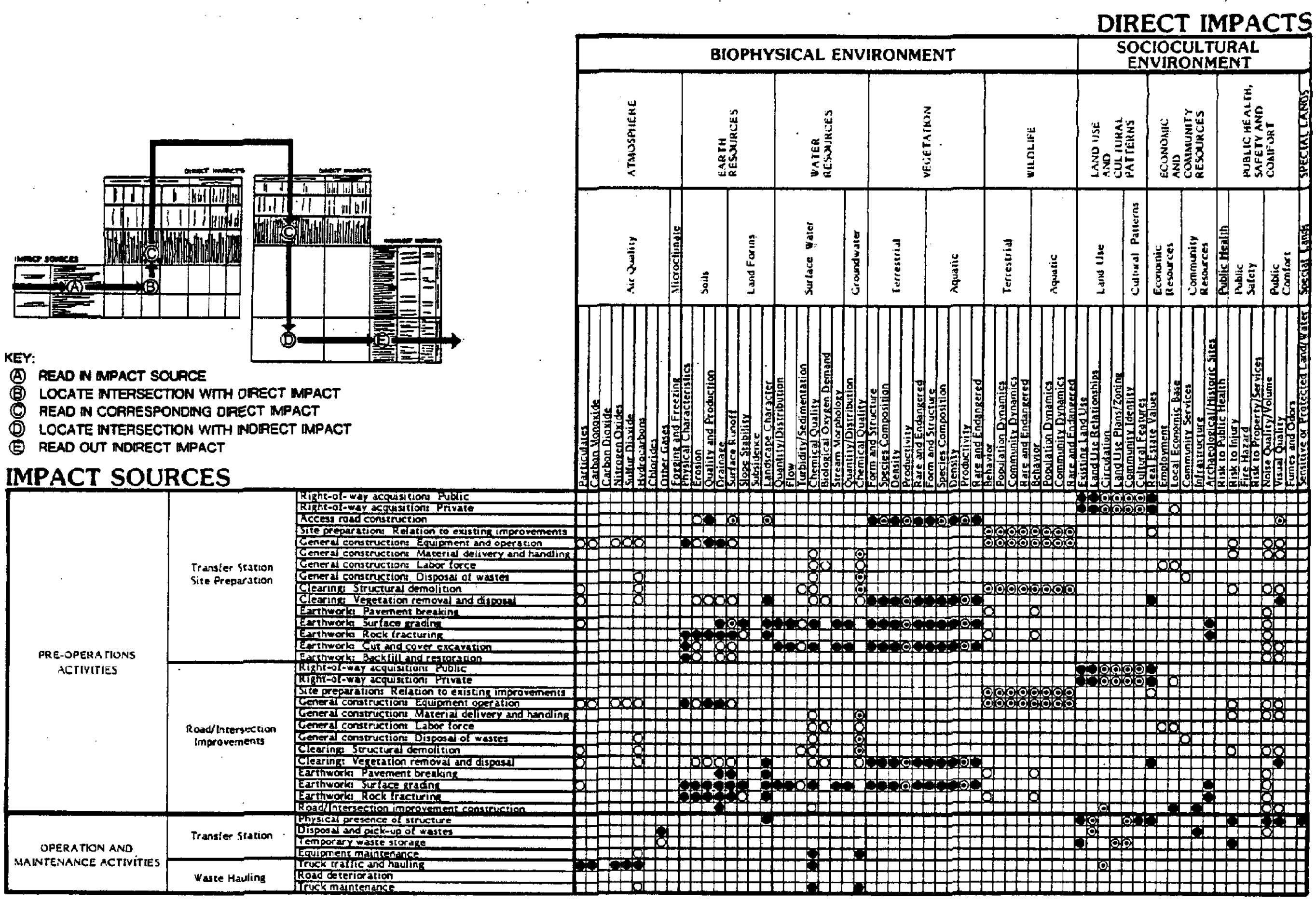
Source: Tables 2-5.

daily and annual pollutant production are shown in table 22. It can be seen, given the assumptions made, that the barge alternative adds fewer air pollutants than the trucking alternative.

Load of air pollutants from solid waste trucks compared to other mobile sources over a unit distance. To obtain an approximate idea of the proportion of vehicular air pollutants currently generated by solid waste vehicles and to be generated in 1990, when all solid waste in Middlesex County is directed to the Edgeboro RRF/landfill, we can focus on a mile-long segment of highway for which car and truck traffic counts are available near the area where solid waste trucks converge from all over Middlesex County. The traffic counts can then be converted to tons of air pollutants. Although it is necessary to make a series of assumptions in doing this, it is, nonetheless, a useful comparison to make.

In 1978 about 860 TPD of solid waste arrived at Edgeboro from Middlesex municipalities, 570 TPD from the north and 290 TPD from the south along Route 18. In 1990, when all Middlesex County municipalities are assigned to Edgeboro, it is estimated that 2,460 TPD will arrive from the north along Route 18 and 890 TPD from the south. Assuming five-ton-capacity carriers and no transfer stations, the solid waste truck traffic can be estimated along Route 18. Since the highest impact due to solid waste vehicles along Route 18 will occur to the north of its intersection with Edgeboro Road, we have selected a mile-long stretch of Route 18 from Edgeboro Road north for this analysis.

Figure 18. Impact summary matrix: trucking



Legend:
- Short-Term Impact
- ● Long-Term Impact
- ⦿ Short- and Long-Term Impact

Source: Rogers, Golden & Halpern.

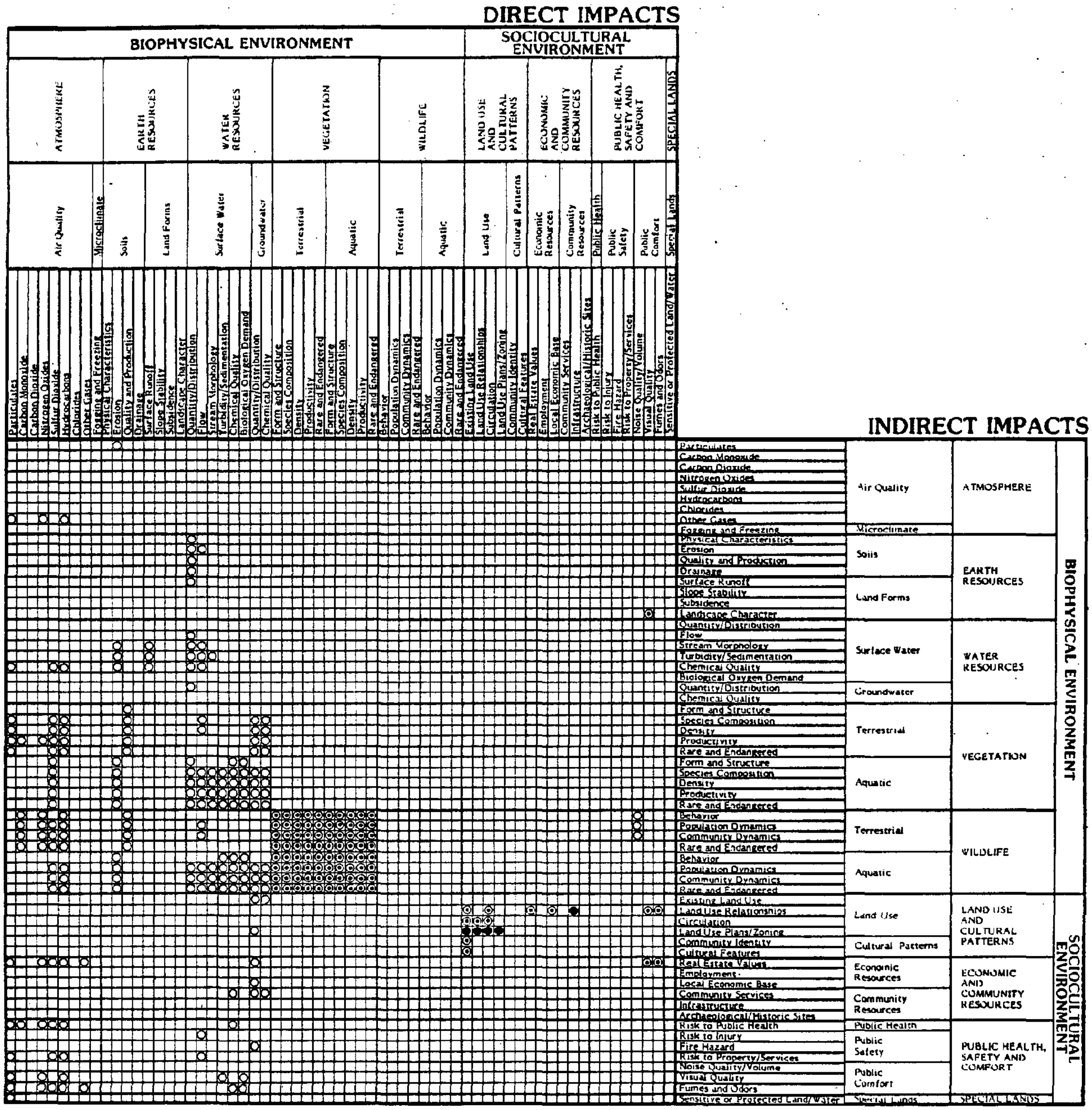
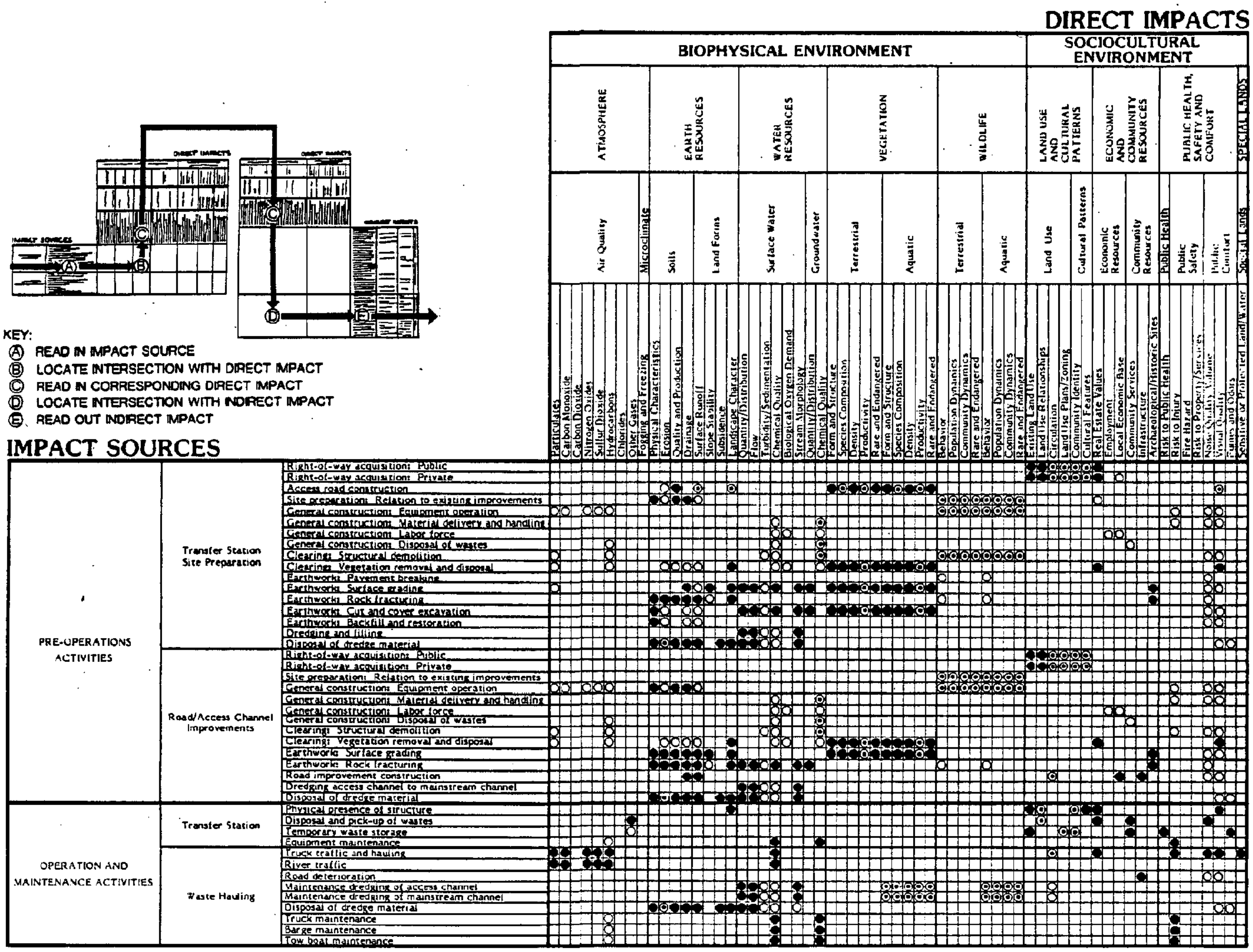

DIRECT IMPACTS
BIOPHYSICAL ENVIRONMENT
SOCIOCULTURAL ENVIRONMENT
ATMOSPHERE
EARTH RESOURCES
WATER RESOURCES
VEGETATION
WILDLIFE
LAND USE AND CULTURAL PATTERNS
ECONOMIC AND COMMUNITY RESOURCES
PUBLIC HEALTH, SAFETY AND COMFORT
SPECIAL LANDS
Air Quality
Microclimate
Soils
Land Forms
Surface Water
Groundwater
Terrestrial
Aquatic
Terrestrial
Aquatic
Land Use
Cultural Patterns
Economic Resources
Community Resources
Public Health
Public Safety
Public Comfort
Special Lands
INDIRECT IMPACTS
Particulates
Carbon Monoxide
Carbon Dioxide
Nitrogen Oxides
Sulfur Dioxide
Hydrocarbons
Chlorides
Other Gases
Fogging and Freezing
Physical Characteristics
Erosion
Quality and Production
Drainage
Surface Runoff
Slope Stability
Subsidence
Landscape Character
Quantity/Distribution
Flow
Stream Morphology
Turbidity/Sedimentation
Chemical Quality
Biological Oxygen Demand
Quantity/Distribution
Chemical Quality
Form and Structure
Species Composition
Density
Productivity
Rare and Endangered
Form and Structure
Species Composition
Density
Productivity
Rare and Endangered
Behavior
Population Dynamics
Community Dynamics
Rare and Endangered
Behavior
Population Dynamics
Community Dynamics
Rare and Endangered
Existing Land Use
Land Use Relationships
Circulation
Land Use Plans/Zoning
Community Identity
Cultural Features
Real Estate Values
Employment
Local Economic Base
Community Services
Infrastructure
Archaeological/Historic Sites
Risk to Public Health
Risk to Injury
Fire Hazard
Risk to Property/Services
Noise Quality/Volume
Visual Quality
Fumes and Odors
Sensitive or Protected Land/Water

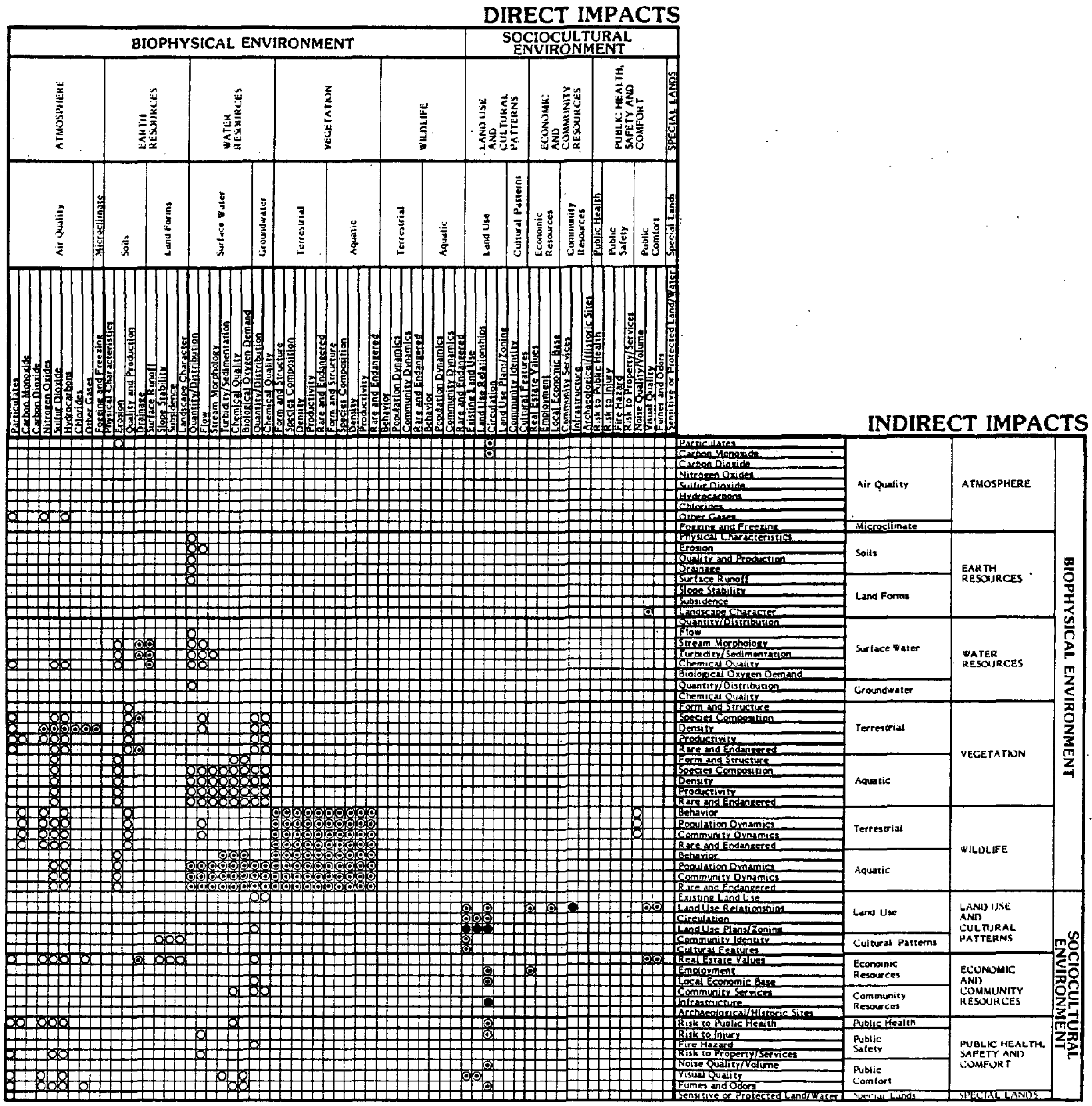
Figure 19. Impact summary matrix: barging



Legend:

- ○ Short-Term Impact
- ● Long-Term Impact
- ⊙ Short- and Long-Term Impact

Source: Rogers, Golden & Halpern.


DIRECT IMPACTS
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Public Health
Public Safety
Public Comfort
Special Lands
INDIRECT IMPACTS
Particulates
Carbon Monoxide
Carbon Dioxide
Nitrogen Oxides
Sulfur Dioxide
Hydrocarbons
Chlorides
Other Gases
Fogging and Freezing
Physical Characteristics
Erosion
Quality and Production
Drainage
Surface Runoff
Slope Stability
Subsidence
Landscape Character
Quantity/Distribution
Flow
Stream Morphology
Turbidity/Sedimentation
Chemical Quality
Biological Oxygen Demand
Quantity/Distribution
Chemical Quality
Form and Structure
Species Composition
Density
Productivity
Rare and Endangered
Form and Structure
Species Composition
Density
Productivity
Rare and Endangered
Behavior
Population Dynamics
Community Dynamics
Rare and Endangered
Behavior
Population Dynamics
Community Dynamics
Rare and Endangered
Existing Land Use
Land Use Relationships
Circulation
Land Use Plans/Zoning
Community Identity
Cultural Features
Real Estate Values
Employment
Local Economic Base
Community Services
Infrastructure
Archaeological/Historic Sites
Risk to Public Health
Risk to Injury
Fire Hazard
Risk to Property/Services
Noise Quality/Volume
Visual Quality
Fumes and Odors
Sensitive or Protected Land/Water
BIOPHYSICAL ENVIRONMENT
SOCIOCULTURAL ENVIRONMENT

Table 22. **Air emissions of vehicles from all Middlesex County municipalities transporting solid waste to the Edgeboro resource recovery facility/landfill in 1990**

	Barge alternative				Truck alternative
	Truck to Edgeboro directly	Truck to barge transfer station--Site 12	Barge to Edgeboro	Total	Total
Daily (kilograms)					
Carbon monoxide	116.0	13.2	9.9	139.1	359.0
Hydrocarbons	18.6	21.3	3.6	43.5	58.0
Nitrogen oxides	84.6	96.8	69.9	251.3	262.0
Annual (metric tons)					
Carbon monoxide	34.8	4.0	3.0	41.8	107.0
Hydrocarbons	5.6	6.4	1.1	13.1	17.3
Nitrogen oxides	25.4	29.0	21.0	75.4	78.5

Source: Tables 2-5.

A 1975 count for this section was 69,000 (both directions), and in 1977 it was 80,700. Middlesex County estimates the 1980 count at 74,336, and NJDOT projects 1982 counts at 105,000. Among these counts, trucks then range from 11,040 in 1975 to 12,912 in 1977 and 11, 894 estimated in 1980 (based on percentage default value).

Based on traffic counts and the geometry of the Route 18-Old Bridge Turnpike-Edgeboro Road intersection, the carbon monoxide levels already exceed the 9 ppm standard and the intersection can be identified as a carbon monoxide hotspot. According to 1980 counts, the worst-case scenario is 20.8 ppm of carbon monoxide. This will only increase with higher counts and no change in the intersection design.

Assuming that vehicular traffic will remain constant between 1980 and 1990, with the exceptions that solid waste vehicles from northern Middlesex County will increase by 756 (both directions), and that the number of solid waste vehicles in 1980 was the same as in 1978, it can be calculated that the percentage of trucks on Route 18 that are solid waste vehicles will increase from 3 percent in 1980 to 12 percent in 1990.

Using the emission factors for highway mobile sources presented in table 2, we can convert the annual average daily traffic (AADT) for cars and trucks to daily pollutant loads along the mile of Route 18. The results of these calculations are shown in table 23.

These calculations show that about 4 percent of nitrogen oxides, and less of the other pollutants, will be attributable to solid waste carriers in 1990. A more detailed examination of trucking operations and emissions could modify this estimate in many ways. However, it does give an approximate idea of the relative magnitude of the air pollution problem due to solid waste trucks to be expected in 1990.

Four-fifths of the solid waste vehicle air pollutant loads estimated above for 1990 would be eliminated from Route 18 north of Edgeboro Road if a barge transfer station were located along the Raritan River. Since three approach routes are used for the site selected for cost analysis, the unit distance impacts due to solid waste vehicles would be less (see Chapter 4).

The estimated truck AADT for Edgeboro Road in 1980 was 475, based on an adjusted AADT figure for Edgeboro Road of 5,279.

Truck traffic on Edgeboro Road. The Edwards and Kelcey study (1980) reports peak hour counts for cars and trucks on Edgeboro Road (table 24).

Peak hour counts do not provide a very good basis for estimating the proportion of traffic made up by solid waste trucks, since their arrival and departure at the RRF do not begin until the first

Table 23. Estimated air pollutant production by cars and trucks per day along Route 18, north of Edgeboro Road, 1980 and 1990

	Air pollutants (metric tons/mi)	
	1980	1990
Automobile (gasoline—1972 or later model)		
Carbon monoxide	2.30	2.30
Hydrocarbons	.19	.19
Nitrogen oxides	.28	.28
Truck (heavy duty diesel)		
Carbon monoxide	.34	.36
Hydrocarbons	.05	.06
Nitrogen oxides	.25	.26
Total		
Carbon monoxide	2.64	2.66
Hydrocarbons	.24	.25
Nitrogen oxides	.53	.54
	Percentage of total due to solid waste vehicles	
Carbon monoxide	.2	1.1
Hydrocarbons	.4	1.8
Nitrogen oxides	.9	3.8

Source: Tables 2-5.

Table 24. Peak hour traffic counts, Edgeboro Road

	Morning Peak 7:30-8:30 a.m.	Afternoon Peak 4:45-5:45 p.m.
Inbound cars (toward landfill)	175	112
Inbound trucks	26	30
Total	201	142
Outbound cars (away from landfill)	55	163
Outbound trucks	59	13
Total	114	176

Source: Edwards and Kelcey, Inc., 1980.

round of collection is completed, which in most cases is after the morning peak. However, if solid waste truck arrival is fairly evenly distributed over a 10-hour period, say 9 a.m. to 7 p.m., the estimated hourly average for solid waste trucks from Middlesex County municipalities is about 20 trucks in one direction. By 1990, this hourly average will have increased to about 70 trucks. Comparison of these estimates with peak hour truck counts shows that Edgeboro Road will experience between two and three times the present truck traffic as a result of the closing of other disposal sites and the assignment of all of Middlesex County municipal waste to the Edgeboro RRF/landfill. If a barge transfer station facility were built and operated along the Raritan River, by 1990 an average of about 30 solid waste trucks per hour would travel (one way) along Edgeboro Road. This level of truck traffic is similar to the peak hour truck traffic shown in table 24.

Solid waste transportation impacts on urban areas: a comparison of the trucking and barging alternatives. It is possible to make an approximate comparison of the severity of such truck-traffic related impacts as air pollution and noise on residential neighborhoods with and without the barge transfer station by examining the solid waste truck-miles traveled on urban streets in the barge service area. Based on the truck routes selected and the solid waste loads predicted for 1990 (see Chapter 4), it can be shown that in the barge service area, the direct trucking alternative would involve 1,280 truck-miles on urban streets daily, whereas the barge alternative would involve 1,630 truck-miles on urban streets. Thus, on a fairly gross level, the barging alternative would have the greater impact on concentrations of people.

Public Health, Safety, and Comfort

Risk to public health. The design of the transfer station should prevent any public health problems associated with vermin. Traps or poison around the facility should take care of any problem.

Visual quality. A transfer station would visually dominate the waterfront in a rural area but would probably blend in well in the industrialized portions of the study area. Figure 20 illustrates a typical transfer station site plan. A component of a transfer station, the compaction facility, is illustrated in figure 21.

The public is accustomed to seeing trucks and barges, and vehicles likely to serve the proposed facility are typical. Figure 22 shows solid waste trucks. A typical barge is illustrated in figure 23.

MITIGATIVE ACTIONS

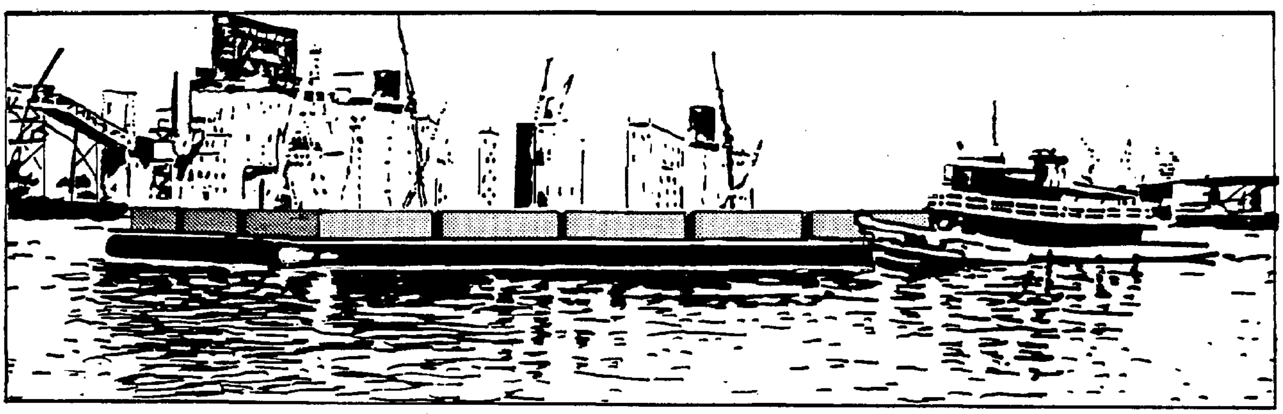
Construction and Operation of a Resource Recovery Facility at East Brunswick

While it can be assumed that construction and operation of a resource recovery facility will follow standard engineering practices consistent with a concern for environmental values and that federal and state standards will be met, there are additional opportunities to mitigate impacts. The following measures may be helpful in avoiding or reducing the adverse effects of construction and operation of the proposed RRF at East Brunswick. When construction and operation plans are released by Wheelabrator-Frye, the discussion of mitigative actions can be refined.

The following actions should mitigate the environmental impacts associated with the construction and operation of the proposed RRF.

- To minimize the adverse impacts of dust and other suspended matter on the environment, apply water sprays on problem sites.
- Route wastewater and effluent from tipping area washdown to a holding tank for stabilization and discharge. At no time should process or sanitary wastewater be discharged to any surface water or groundwater.
- For emergency flood control, divert flood waters to a retention pond for subsequent use as cooling water.
- Pave roads and parking areas at the plant and sweep them regularly to reduce dust accumulation.
- Enclose the tipping area and withdraw primary combustion air from it. Sweep this air across the refuse pit to control

Figure 23. Typical barge



Source: Rogers, Golden & Halpern.

dust, odors, and emissions from the exhausts of trucks in the tipping area.

- Contain residue- and flyash-handling operations within the plant enclosure. Transfer of residue from ash pit into trucks should occur within an enclosed area.

- In order to assure that noise generated within the facility does not create an unacceptable noise level outside, insulate the outside walls of the buildings for sound control. Also, identify equipment that is inherently noisy in operation so that it can be installed within the buildings.

- Maintain natural cover to the greatest extent practicable near streams and swales to reduce erosion and to aid in the infiltration of rainfall and surface runoff. Minimize removal of streamside vegetation and maintain a 10- to 100-foot buffer strip between water bodies and activity areas. Revegetation or refilling trenches with a quickly established ground cover of annual grasses and clover before seasonal rains will minimize increases in inorganic sedimentation.

- In the event of spills of insulating oil, institute prompt cleanup action. Develop an emergency action program to maximize environmental protection.

- Stockpile soil that has been excavated during construction and spread it back onto the cleared area during restoration. The soil should be graded to conform with the terrain of adjacent land forms.

- Use terracing, contouring, and other erosion control techniques to prevent soil erosion by wind and water.

- Minimize off-road vehicle traffic and use dust suppression measures on access roads, storage areas, and other locations of vehicle movement.

- Minimize the amount of land disturbed at one time through phasing of construction.

- In order to protect the remaining vegetation, avoid wounding trees, changes in soil moisture and water table levels, and changes in grade and compaction of soil over roots. A buffer zone 1½ times the diameter of the tree canopy should be protected during construction. Filling over root systems and cutting roots should be avoided.

- Avoid obstruction of potential wildlife habitats and migratory paths during above-ground construction. Breaks should be left every 400 to 600 feet along open ditches to allow animals to cross.

- Attempt to keep personnel from disturbing nesting sites or dens; from using off-road vehicles outside the immediate area necessary for construction activity; and from engaging in any unnecessary disturbance of wildlife, such as displacing logs and large rocks that are frequently habitats for reptiles and amphibians.

- In all herbicide application projects, avoid water contamination if possible. Preventive measures include leaving a buffer strip on either side of a water course; ground application of herbicides as opposed to aerial application; using thickened sprays when aerial application is necessary; and limiting spraying activities to ideal weather conditions (no wind, rain, or turbulent conditions).

- Avoid road construction along or near streams, and employ road construction methods that have been found to minimize erosion, such as increasing the angle to the backslope, thereby reducing the area of slope subject to erosion, and keying in all fill material and compacting the subgrades.

- Schedule area and time of activity around water bodies to minimize impact on fish habitat and reproductive functioning.

- Where possible, confine activities resulting in siltation or stream channel scouring to periods when terrestrial food is highest in fish diet (generally summer) and periods after fry have emerged from gravel and before spawning begins.

Construction and Operation of an Electrical Transmission Line

The following actions should help to mitigate the environmental impacts associated with the construction and operation of an electrical transmission line. In addition, many of the actions associated with earthwork techniques that were listed in the previous section on RRFs would also apply here.

- Make use of existing planned utility corridors or plan new corridors in cooperation with other utilities, highway or regional planning agencies, and local planning staff.

- Locate right-of-way to provide linkages between associated uses that can be enjoyed by cyclists or pedestrians as alternatives to streets. Valuable linkages in suburban areas can provide interneighborhood connectors between homes and school, homes and store or commercial area, and homes and park.

- o Where such linkages cannot easily be developed, consider existing neighborhood and community boundaries and circulation patterns in right-of-way selection.

- o Route right-of-way to follow property lines.

- o Encourage the development of compatible multiple uses. These might include the following.

  - Trail systems can be constructed for hiking, bicycling, or horseback riding.

  - Linear parks can be created where the width of the right-of-way is sufficient (i.e., over 125 feet). To encourage maximum use, link the route with neighborhood parks or small open spaces to be provided by developers. The use of parks can be increased by extending parks in this way.

  - Where appropriate, portions of the right-of-way may be incorporated into commercial recreation areas and used for ski trails, golf courses, game refuges, and stables.

  - After cable installation, existing agricultural lands should be leased back or, in the case of utility-owned easements, should continue as grazing or arable lands.

  - Other possible commercial multiple uses are tree farms, Christmas tree farms, nurseries, building materials storage, and parking. These uses do not require permanent structures and are relatively easy to clear if necessary to gain access to the right-of-way. Their inclusion in portions of a right-of-way represents an efficient use of lands that are not suitable for other needs.

- o Schedule construction around school terms to avoid schools, playgrounds, and parks during periods of peak use.

- o Involve the public in the right-of-way routing process, pointing out alternatives available, probable impacts, and multiple use opportunities.

- o Where rights-of-way cross arable land, schedule regular maintenance access in the nonproductive periods.

- o Obtain details of existing land-drains on agricultural land during routing, and if necessary install new drainage facilities to avoid creating "wet spots" and damaging crops.

- o Evaluate the size, density, and distribution of population and the population growth trends in the vicinity of all routes and sites under consideration to avoid relocation and minimize the number of residents affected by indirect impacts on amenity such as noise and visual quality impacts.

- In the routing and siting process and proposals for multiple use, take account of community goals published or recorded in general plans and special-purpose studies relating to housing, work, recreation, and cultural activities, impacted neighborhoods' perceptions of neighborhood character and needs, and attitudes toward the intrusion of the transmission line right-of-way.

- Conduct a thorough investigation of unique and locally important cultural features along each alternative right-of-way by field survey and by contacting the Department of the Interior, local colleges, and preservation groups. Map all features and known historic and archaeological sites to provide an indication of where new sites may be found.

- To avoid disruption of local traffic patterns, schedule materials shipment, handling, and unloading at times other than periods of peak traffic flow. Suitable detours should be carefully monitored and established, should portions of any major roadway be obstructed for a period of time.

- Maintain electrical transmission line right-of-way vegetation in such a way as to preserve habitats for terrestrial fauna.

- Give use of selective herbicides first consideration for maintenance of the electrical transmission line right-of-way. This should permit an acceptable level of woody plant control and at the same time, improve habitat for specific species.

Transportation of Solid Waste to a Resource Recovery Facility at East Brunswick

The following measures, in addition to those noted above, may be helpful in avoiding or reducing the adverse effects of transporting solid waste by truck or barge. Most of the mitigative measures that follow refer to transfer station construction and operation. All measures noted are applicable to the East Brunswick RRF project.

- During the site selection process, consider archaeological and historic sites as a siting criterion. Consult the NJDEP Office of Cultural and Environmental Services.

- Ensure that all waste storage facilities are properly secured from vermin infestation.

- Fence or otherwise protect construction sites and equipment to preclude unauthorized public entry.

- Mark construction areas clearly and light them to direct vehicles and/or craft safely past obstructions.

- Have supervisors emphasize proper equipment operation and maintenance in order to instill an awareness in workers that will result in improved accident rates.

- Refrain from site preparation work during periods of inclement weather (i.e., rain).

- If accident rates increase during the hauling of solid wastes, institute driver education, road/intersection improvements (if the data indicate a high accident rate at one location), or the use of different roads.

- To diminish the potential negative impact on adjacent real estate values, attempt to (1) purchase a parcel of land large enough to buffer the transfer station from adjacent properties, (2) design the site in a manner that will shield the structure from views outside the property, and (3) retain as much vegetation as possible.

Many of the ameliorative recommendations that will reduce or avoid negative impacts resulting from trucking are the products of good planning and good management. Truck routes can be established that will minimize any negative impacts to property values, public safety, sensitive land uses, and traffic flow. Good management and good maintenance practices will minimize any potential negative impacts to air quality or water quality. The probability of spills of solid waste or fuels and incidents of vermin serving as disease vectors can also be reduced to insignificant levels by good management and maintenance practices.

Many of the potentially negative impacts associated with the construction and operation of barge facilities also can be reduced by wise planning decisions. Water-related construction can be minimized by careful selection of sites. Marshes or wetlands should be avoided whenever possible and construction activity should be timed to present the fewest possible impacts. Planning and good management will reduce the potential of a solid waste or fuel spill. Clean-up contingency plans will reduce impacts if a spill should occur. Impacts resulting from the construction of loading and unloading facilities can be minimized by wise planning in the choice of disposal sites and use of the disposal technique most suited to the type of material to be dredged and the local terrain.

PERMITS AND AGENCY REVIEWS

The proposed resource recovery facility and the transfer stations require several permits, certifications, and approvals before construction and operation can begin. Appendix B lists federal and state permits and the general types of local permits necessary to build the sort of RRF planned for Edgeboro at any location in New Jersey. Appendix C contains permits and reviews specific to the proposed RRF site in East Brunswick Township, Middlesex County.

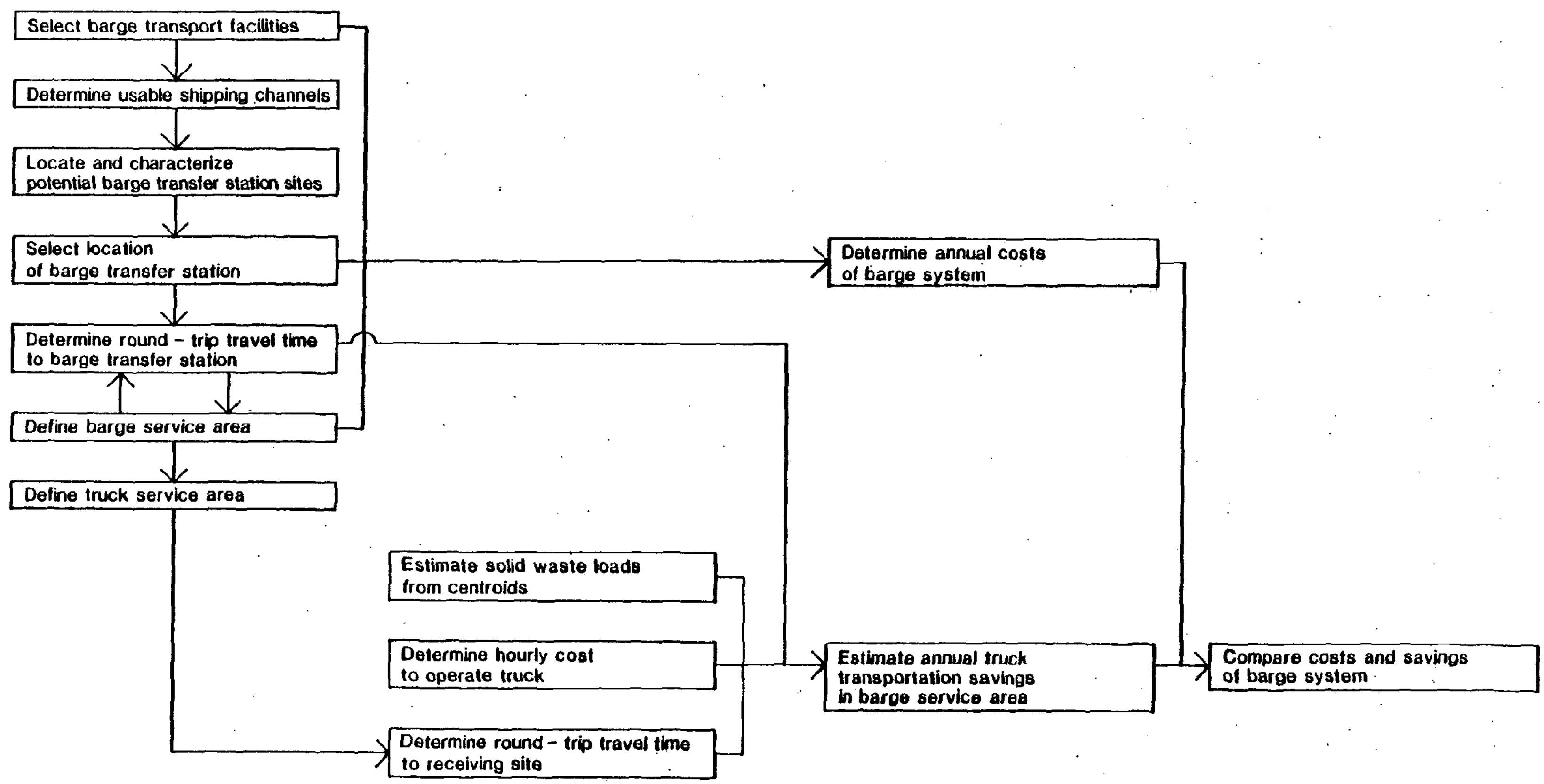
CHAPTER 4. COST COMPARISON—TRUCKING AND BARGING SOLID WASTE

SUMMARY

This chapter presents and applies to Middlesex County a methodology that defines a service area for barging solid waste to a final receiving site and then estimates the cost difference between trucking all solid waste directly to that site and trucking waste in the barge service area for water transport to the final receiving site. The methodology also incorporates the estimated costs of constructing and operating a barge transfer station for comparison with possible savings in truck transportation costs.

The first section of this chapter describes the barge-truck cost comparison methodology. The basic steps and their relationships are shown in figure 24. In the next section of the chapter, the method is applied to all municipalities in Middlesex County. On the basis of this application, it is estimated that about $1 million per year in truck transportation costs will be saved in 1990 by trucking solid waste from 11 municipalities in northern and eastern Middlesex County to a barge transfer station near the mouth of the Raritan River. However, the annual cost of constructing, operating, and maintaining such a barge transfer station is estimated to be $9.8 million, nearly 10 times the potential saving in truck transportation costs.

Figure 24. Methodology for comparing trucking and barging costs



Source: Rogers, Golden & Halpern.

METHODOLOGY

Estimation of the Solid Waste Load To Be Carried to the Receiving Site

Based on known municipal solid waste loads (SW), the population for the year of load data (P), the projected population levels (Pf), and the fraction of load assigned to the receiving site (a), estimate the solid waste load from each municipality (SW_f) that will be directed to the receiving site:

$$SW_f = a(SW)\frac{(Pf)}{(P)}$$

This expression assumes that the per capita solid waste generation rate remains constant. Gaps in the solid waste load data should be filled by interpolation, using the per capita generation rate of another municipality with a similar land use profile.

Determination of the Hourly Cost of Operating Solid Waste Carriers

Based on actual, recent experience in the study area or in another jurisdiction, estimate the hourly cost of operating each class of solid waste carrier to be used at the target date. The cost data should, if possible, include annual costs of:

- labor
  - driver
  - loader(s)
  - overhead costs allocated to labor
- truck, amortized over n years
- maintenance
- fuel and oil
- insurance
- other known costs

The total annual costs by vehicle type are then divided by the number of working hours in a year to give the hourly cost of operating a solid waste carrier.

Determination of Round-Trip Travel Times from Each Municipal Solid Waste Centroid to the Receiving Site

The most direct route from each municipal solid waste centroid to the receiving site is determined and mapped and the mileage measured for three categories of roads: urban streets, rural and limited access roads, and superhighways.

The route selected should minimize the use of urban streets and should, if possible, take into account roads not yet built for

Table 25. Design components of a truck-to-barge transfer station

Municipal solid waste handling capacity (TPD)	Component						
	Personnel	Area (acres)	Docks	Cranes	Compactors	Trailers	Tractors
200	9	3.3	1	1	1	13	3
400	10	4.9	1	1	1	26	3
600	13	6.6	1	1	2	39	4
800	14	8.3	1	1	2	52	5
1,000	15	9.9	2	2	3	65	5
2,000	31	18.9	3	3	6	137	8

Source: Greeley and Hansen.

Table 26. Estimated costs of a truck-to-barge transfer station

Municipal waste handling capacity (TPD)	Cost (x$1,000)			
	Initial capital	Amortized capital	Annual O&M	Total annual
200	$ 8,440	$ 820	$ 400	$1,220
400	10,050	980	520	1,500
600	12,140	1,180	690	1,870
800	14,000	1,360	820	2,180
1,000	21,300	2,070	1,090	3,160
2,000	37,990	3,690	2,000	5,690

Source: Greeley and Hansen.

which funding has been authorized. USGS 7½' quadrangle maps, NJDOT highway maps, and county road maps are used to delineate solid waste trucking routes. An average truck speed is assumed for each road type.

The round-trip travel time for each municipality is determined by calculating the one-way time spent on each route segment, (distance divided by speed), summing the time for all route segments, and doubling the sum.

Selection of Barge Transport Facilities

There are three main components of a solid waste transport system involving barges:

- o truck-to-barge transfer station(s), where municipal solid waste brought by truck to a waterfront site is received and loaded onto barges
- o barges and towboats to carry the solid waste from the transfer station to the disposal site
- o unloading station at the disposal site

Selection of the barge loading, transporting, and unloading system should take the following factors into consideration:

- o Spillage and odors should be minimized.
- o System components should be proven technologies and should be commercially available.
- o The cost of the overall system should be reasonable.
- o The channel near the disposal site should accommodate barges of the size selected.

The total annual costs of using the barge system to transport solid waste are a function of the solid waste load. Table 25 shows the number of design components needed for barge transfer stations of various daily handling capacities. The estimated initial capital, amortized capital, annual operation and maintenance (O&M), and total annual costs of the barge system components are presented in table 26.

The design features of the barge haul part of the solid waste barging system are shown in table 27. Corresponding costs by haul distance are given in table 28. A brief cost analysis indicated lower costs for leasing, as opposed to purchasing, barges and towboats. For this reason, cost estimates are based upon the leasing of barges and towboats as needed. The lease cost includes all capital and operation and maintenance expenditures, except personnel and diesel fuel.

At the receiving end, the unloading facility is nearly the same as the transfer station except that there are no additional trailers and only half the area and fewer personnel are required. The unloading facility components required by a range of unloading capacities are shown in table 29. The capital and operation and maintenance costs for unloading stations are presented in table 30.

The capital and operation and maintenance cost assumptions that were used to develop the cost estimates in this study are presented in tables 31 and 32. The cost estimates reflect current labor and utility rates and structure and equipment costs adjusted to the Engineering News-Record Construction Cost Index (ENRCCI) of 3466. The ENRCCI reflects the actual reported costs of labor and basic materials used in the heavy construction industry.

The bases of the capital cost estimates are given in table 31. Capital cost estimates are based on telephone quotations from vendors and actual costs experienced at similar facilities. The cost data used to make the estimates have been updated by the ENRCCI to reflect current prices.

The interest rate, equipment life, and structure life figures used in this study were selected in accordance with accepted cost-effectiveness analysis guidelines. The assumed equipment project life of 20 years is also consistent with the experiences of similar facilities.

Cost estimates in this report are presented on an annual cost basis. Annual cost is defined as the annual operation and maintenance expenditure plus the annual principal and interest payment on the capital costs over the period at the assumed interest rate. The bases of the operation and maintenance cost estimates are given in table 32. Operation and maintenance costs include the costs of administration, operation and maintenance, labor, electricity, and maintenance materials.

Determination of Accessible Shipping Channels for Barges of the Type Selected

Once the barge type is selected and its dimensions are known, the channels navigable by the barge to the disposal site can be identified. The best source for this information is the national ocean survey map series published by National Oceanic and Atmospheric Administration. These maps will indicate shipping channels and characterize by reach, controlling depths, and US Army Corps of Engineers dredging project dimensions (width, length, and depth).

Table 27. Design components of barge hauling

Municipal solid waste handling capacity (TPD)	Component				
	Personnel by haul distance				
	5 mi	10 mi	20 mi	Barges	Towboats
200	2	2	4	1	1
400	2	2	4	1	1
600	2	4	4	1	1
800	2	4	4	2	1
1,000	2	4	4	2	1
2,000	4*	--	--	4	2

Source: Greeley and Hansen.

* Calculated for 5.5-mi one-way haul.

Table 28. Estimated costs of barge hauling by haul distance

Municipal solid waste handling capacity (TPD)	Total annual cost* (x$1,000)		
	5 mi	10 mi	20 mi
200	$300	$440	$770
400	350	490	820
600	400	580	870
800	480	660	950
1,000	410	550	880
2,000	526**	--	--

Source: Greeley and Hansen.

* Includes all personnel and equipment leasing costs. Leasing costs include all capital and operation and maintenance expenses.

** Calculated for 5.5-mi one-way haul.

Table 29. Design components of an unloading station

Municipal solid waste handling capacity (TPD)	Component				
	Personnel	Area (acres)	Docks	Cranes	Tractors
200	6	1.4	1	1	3
400	6	2.2	1	1	3
600	7	3.0	1	1	4
800	8	3.7	1	1	5
1,000	9	4.5	2	2	5
2,000	15	9.0	3	3	8

Source: Greeley and Hansen.

Table 30. Estimated costs of an unloading station

Municpal solid waste handling capacity (TPD)	Cost (x$1,000)			
	Initial capital	Amoritzed capital	Annual O&M	Total annual
200	$ 6,330	$ 610	$ 350	$ 960
400	6,450	620	450	1,070
600	6,740	650	590	1,240
800	7,020	710	720	1,430
1,000	12,720	1,230	960	2,190
2,000	19,500	1,900	1,730	3,630

Source: Greeley and Hansen.

Table 31. Assumptions for capital cost estimates for a solid waste barging system

Item	Assumption*
Cost of land	$ 40,000 per acre
Structures	$ 70 per square foot, size according to equipment needs
Installation	40% of equipment
Heating, ventilation, plumbing, and electrical fixtures	22% of structures and installed equipment
Contigencies: engineering, legal, and administrative	35% of total cost
Interest rate**	7.375%
Project life	20 years
Equipment life	
Mobile equipment***	5 years
Stationary equipment	20 years
Container cranes	40 years
Structure life	30 years
Barge capital cost	Amortized capital cost is included in lease cost of $3,000 per month
Towboats	Amortized capital cost is included in lease cost of $180 per hour
ENRCCI	3466

Source: Greeley and Hansen.

* Where available, vendor's data and in-house data were used in place of these assumptions.

** The noted interest rate was published by the Water Resources Council for FY 1981, to be used by federal agencies in the formulation and evaluation of plans for water and related land resources.

*** Unit costs have been corrected to account for the shorter service life of these items.

Table 32. Assumptions for annual operation and maintenance cost estimates for a solid waste barging system

Item	Assumption
Personnel	Salaries from Middlesex County Personnel Department , FY 1981 operating budget
Energy	
Electricity	$0.055 per kilowatt hour
Diesel fuel	$1.20 per gallon
Maintenance	
Structures	0.5% of capital cost
Stationary equipment	1.5% of capital cost
Mobile equipment	10.0% of capital cost
Container cranes	5.0% of capital cost
Barges	Annual O&M cost is included in lease cost of $3,000 per month*
Towboats	Annual O&M cost is included in lease cost of $150 per hour*

Source: Greeley and Hansen.

* Lease cost obtained from a survey of barge operators in the metropolitan New York City area.

More specific information about actual project work on a channel reach should be obtained from the district Corps office.

Location of Potential Barge Transfer Station Sites Along Accessible Channels

The purpose of this step is to obtain a general idea of the spatial distribution of sites that could be used for barge transfer stations. It is intended not to be an exhaustive search for the best site or sites but to yield possible locations for the purpose of estimating the cost feasibility of the barge option. The brief procedure described below is intended to identify such locations.

The land along the waterfront of accessible channels is examined for areas larger than three acres that have the following characteristics:

- open land or unused industrial land
- absence of wetland
- absence of flood hazard
- absence of steep slopes
- access to paved roads
- absence of sensitive land uses nearby or along immediate access routes

This preliminary screening procedure can be applied using 7½' USGS quadrangle and Federal Insurance Administration flood hazard maps of the study area. The resulting sites are then examined more closely, using additional geographic data and site visits.

- Land use: Eliminate sites that are not zoned industrial or are not proposed for industrial use in municipal land use plans.
- Accessibility: Estimate the total volume of dredging required to connect the transfer station docking area to the shipping channel. On a site visit, rank sites according to condition and land uses along the access road.
- Site profile: Based on the site visit evaluation, rank each site according to existing docking facilities and size of usable land area.

All relevant site characteristics are then arrayed for each potential site and sites are qualitatively ranked from most to least acceptable by characteristic. Eliminate less acceptable sites that are close to highly acceptable ones.

Selection of Location(s) for Barge Transfer Station(s) and Determination of Round-Trip Travel Times

From the potential barge transfer station sites surviving the previous step, one or perhaps several final sites must be selected for further analysis.

The potential barge transfer station sites are located on a road map of the study area. As was done earlier in this procedure, the distance for three road categories and the corresponding round-trip times are determined from each municipal solid waste centroid to each potential barge transfer station site. In actually doing this step, it is possible to eliminate from consideration all centroids that are obviously closer by road to the final solid waste destination than to a barge transfer station site. In toss-up situations, however, the distance should be measured and round-trip times compared. The service area for each potential site is determined by a spatial aggregation of all municipalities closer (in terms of round-trip travel time) to a particular barge transfer station than to the final solid waste destination or to other barge transfer stations.

Estimation of Savings in Solid Waste Transportation Costs Due to the Use of the Barge Transfer Station

In this step the time saved by transporting solid waste from the barge service area centroids to the barge transfer stations, instead of directly to its final destination by truck, is converted to cost savings. These savings are based on the hourly cost of running each kind of solid waste carrier. For example, a municipality is B round-trip minutes closer to the barge transfer station than to the final solid waste destination. Its trucks carry C tons each per trip; its average load generation is D tons per day. If each truck costs E dollars per hour to operate, the annual cost savings (ACS) to the municipality are then:

$$ACS = \frac{B\ D\ E}{C}\ (5\ \text{day hours/min year})$$

The component 5 day hours/min year is a conversion factor.

This straightforward cost estimation procedure assumes that the time saved can be directly translated into money saved by lower labor, equipment, maintenance, and overhead costs. Since overtime pay and certain fixed costs will all tend to reduce the calculated cost savings, the figure calculated represents an upper limit on the cost savings possible.

After the annual savings for each municipality are calculated, then the total annual savings for each barge service area are obtained by summation across all municipalities in the service area.

Comparison of Costs and Savings of the Barge System

At this final step in the procedure, the transportation cost savings due to the use of the barge transfer station are compared to the estimated costs of the barge transfer system, including the costs of the truck-to-barge transfer stations, the barges and towboats, and the barge-unloading facility at the receiving site.

APPLICATION TO THE PROPOSED EAST BRUNSWICK RESOURCE RECOVERY FACILITY

Estimation of the Solid Waste Load for 1990 To Be Carried to the Edgeboro Landfill

Chapter 3 of this report presents the 1978 total solid waste loads from each municipality in Middlesex County except Metuchen, for which no data were available. The Middlesex County Planning Board has developed municipal population projections for several future milestone years. The target date 1990 was selected for this solid waste barging study because the Edgeboro RRF will be operating by then and all Middlesex County municipal wastes have been assigned to the Edgeboro site, according to the Middlesex County Solid Waste Management Program. Part of this waste stream will be incinerated for energy recovery and the rest will be landfilled.

Application of the expression from the first step in the procedure to these data for Middlesex County yields a projected total solid waste load that must be transported to the Edgeboro site from each municipality. Input data and the results of these calculations are presented in table 33.

Since no population figures were available for 1978, the year for which solid waste load data were available, a 1978 population figure for each municipality was calculated by interpolation, using 1975 and 1980 census data provided by the Middlesex County Planning Board. Furthermore, the 1990 projections, which were done before the 1980 census figures were available, were adjusted by application of a factor derived from 1980 data:

$$\text{1990 adjusted projection} = \frac{\text{(1990 projection)(1980 census)}}{\text{(1980 projection)}}$$

The solid waste load for Metuchen was estimated from the per capita solid waste generation rate of Dunellen, which, although smaller, is similar in land use profile to Metuchen.

Table 33. Population and total solid waste of Middlesex County by municipality

Municipality	Estimated population 1978*	Solid waste 1978** (TPD)	Projected population 1990*	Projected solid waste 1990 (TPD)
Carteret	21,116	150	21,549	153
Cranbury	2,085	21	2,563	26
Dunellen	6,873	23	6,876	23
East Brunswick	39,227	205	43,758	229
Edison	70,261	588	74,513	624
Helmetta	963	24	985	25
Highland Park	14,032	34	14,020	34
Jamesburg	4,450	26	4,330	25
Metuchen	14,761	52***	14,383	51
Middlesex	14,312	130	14,059	128
Milltown	7,012	36****	7,510	39
Monroe	14,359	19	18,775	25
New Brunswick	41,978	274	42,886	280
North Brunswick	21,964	210	26,119	250
Old Bridge	51,589	155****	67,586	203
Perth Amboy	39,239	219	40,538	226
Piscataway	41,159	126	48,225	148
Plainsboro	5,061	26****	11,191	57
Sayreville	31,517	46	36,390	53
South Amboy	8,887	9	8,300	8
South Brunswick	16,396	95	29,415	170
South Plainfield	21,090	67	22,722	72
South River	14,942	52	15,271	53
Spotswood	11,030	19****	8,337	14
Woodbridge	94,720	490	91,036	471
Total for county	609,023	3,044	671,331	3,387

Sources:

* Interpolated from 1975 and 1980 population data (Middlesex County Planning Board, August 1979).

** From Modification 1 to Middlesex County Solid Waste Management Program, July 1980; 300 workdays per year assumed.

*** Estimated value based on per capita generation of solid waste of Dunellen.

**** 1977 value.

Determination of the Hourly Cost of Operating Solid Waste Carriers

For this application, we assume that five-ton rear-loader solid waste trucks are used. Furthermore, it is assumed that there will be no truck-to-truck transfer stations in operation by 1990 in Middlesex County.

Truck operation costs were obtained in the format needed from the Baltimore City Division of Solid Waste. Table 34 shows the breakdown of costs and the derived total cost per hour to operate five-ton trucks.

Determination of the Round-Trip Travel Times from Each Municipal Solid Waste Centroid to the Edgeboro Site

The most direct route from each municipal population centroid to the Edgeboro site was measured and broken down into miles of urban street, rural or limited access road, and superhighway. These routes are shown in figure 25. The time spent on each route segment was calculated using assumed speeds for each highway type:

	mph
o urban street	20
o rural or limited access road	35
o superhighway	55

The results of these measurements and calculations are shown in table 35.

Selection of Barge Transport Facilities

On the basis of a study of current barge technology and barge-compatible solid waste transfer facilities, the following solid waste barge transfer facilities were selected as the most appropriate system for moving solid waste by barge in Middlesex County.

- Barge transfer stations. Solid waste from municipal collections is transferred to rubber-tired transfer trailers (40x8x8 feet, 25.3 tons net) by a compaction machine. The loaded transfer trailers are pulled by truck to a loading dock, where a gantry crane loads the trailers onto a barge.

- Barges and towboats. The standard deck barge is 250 feet long and 38 feet wide. Its load capacity is 1,800 tons. The barges are carried by the towboats to the Edgeboro landfill site.

Table 34. Truck cost assumptions

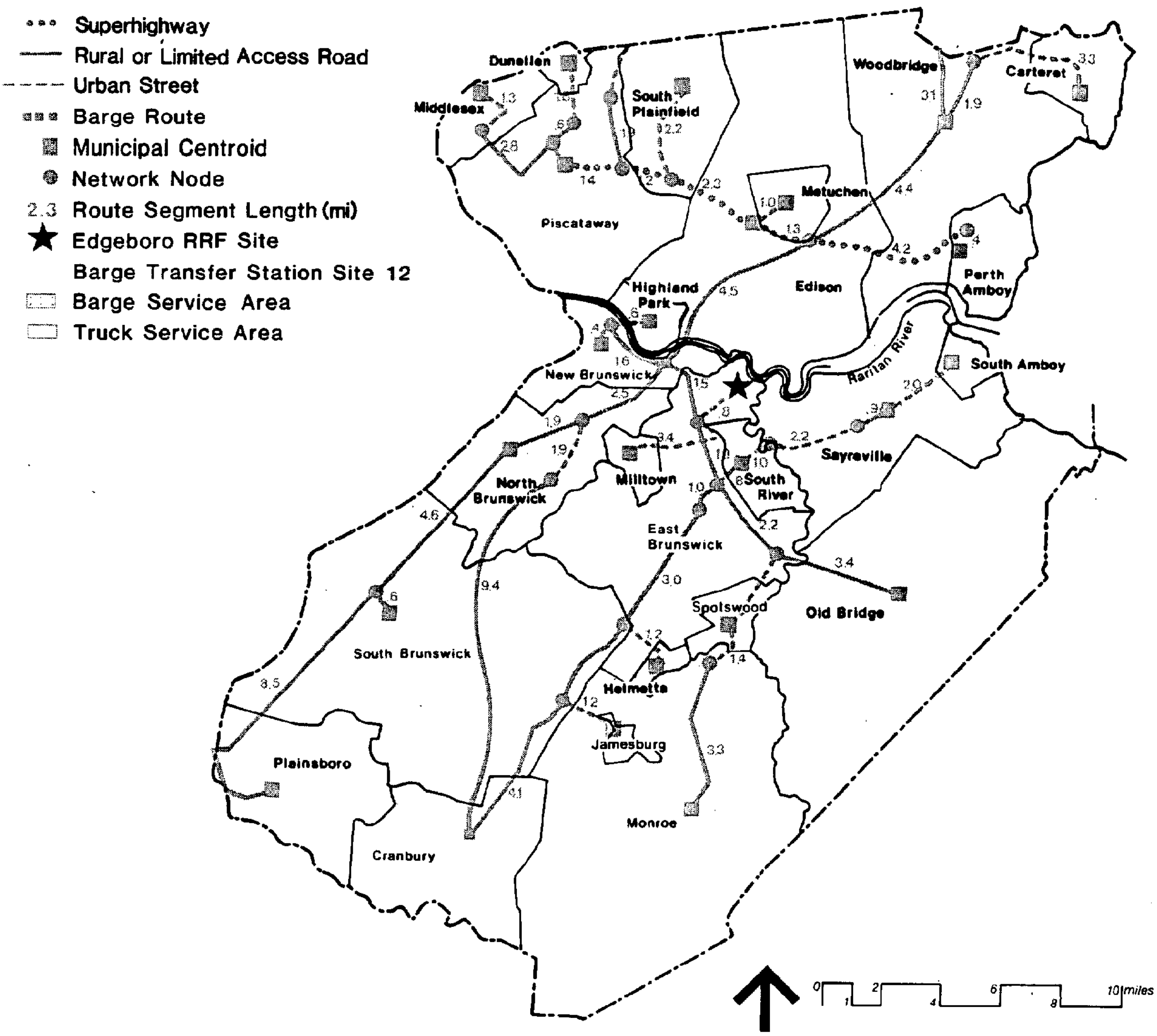
Item	Annual cost*
Labor	
Driver	$14,000
Crew (2)	26,000
Labor overhead 27%	10,800
Truck	
5-ton rear-loader; 5-year amortization	10,000
Maintenance	12,500
Insurance	300
Fuel and oil	3,500
Total	77,100

Hourly cost per truck:
($77,100/year)(year/300 days)(day/8 hours) = $32/hour

Source: Rogers, Golden & Halpern.

*Figures are based on 1980 experience in Baltimore City (Division of Solid Waste); labor costs were increased by 10 percent.

Figure 25. Truck routes to resource recovery facility site



Sources: Rogers, Golden & Halpern; Middlesex County, 1975; US Geological Survey, 1970.

Table 35. Distances and travel times for a solid waste trucking system from municipal solid waste centroids to the Edgeboro site

	Distance (mi)				Travel time (min)			
	One-way			Round-trip (Total)	One-way			Round-trip (Total)
	Urban street	Rural or limited access road	Super-highway		Urban	Rural or limited access road	Super-highway	
Carteret	4.1	12.3	—	32.8	12.3	21.1	—	66.8
Cranbury	.8	12.3	—	26.2	2.4	21.1	—	47.0
Dunellen	2.4	6.9	6.2	31.0	7.2	11.8	6.8	51.6
East Brunswick	1.7	2.9	—	9.2	5.1	5.0	—	20.2
Edison	.8	6.0	1.3	16.2	2.4	10.3	1.5	28.4
Helmetta	2.0	5.9	—	15.8	6.0	11.6	—	35.2
Highland Park	1.4	3.1	—	9.0	4.2	5.3	—	19.0
Jamesburg	2.0	8.2	—	20.4	6.0	14.0	—	40.0
Metuchen	1.8	6.0	1.3	18.2	5.4	10.3	1.4	34.2
Middlesex	2.1	9.1	6.2	34.8	6.3	15.6	6.8	57.4
Milltown	4.2	—	—	8.2	12.6	—	—	25.2
Monroe	4.2	7.4	—	23.2	12.6	12.6	—	50.4
New Brunswick	1.2	3.1	—	8.6	3.6	5.3	—	17.8
North Brunswick	.8	4.9	—	11.4	2.4	8.4	—	21.6
Old Bridge	.8	7.5	—	16.6	2.4	12.8	—	30.4
Perth Amboy	.8	6.4	4.2	22.8	2.4	11.0	4.6	36.0
Piscataway	.8	6.0	6.2	26.0	2.4	10.3	6.8	39.0
Plainsboro	.8	18.3	—	38.2	2.4	31.4	—	67.6
Sayreville	4.8	2.8	—	15.2	14.4	4.8	—	38.4
South Amboy	6.8	2.8	—	19.2	20.8	4.8	—	51.2
South Brunswick	.8	10.9	—	23.4	2.4	18.7	—	42.2
South Plainfield	3.0	6.0	3.6	25.2	9.0	10.3	3.9	46.4
South River	1.6	1.9	—	7.0	4.8	3.3	—	16.2
Spotswood	2.8	4.1	—	13.8	8.4	7.0	—	30.8
Woodbridge	1.8	7.9	—	19.4	5.4	13.5	—	37.8

Source: Rogers, Golden & Halpern.

- o Unloading station. The unloading station at the Edgeboro landfill site includes essentially the same components as the barge transfer station. Solid waste in trailers unloaded from the barges is stored or taken directly to either the RRF for burning or the landfill for burial.

Although the transfer trailer - standard deck barge combination was chosen for this cost analysis, another containerized solid waste system can be described at this point, even though no accurate cost data were available for this report. This is the Altvater system, developed and used in Germany by Thyssen Engineering GMBH. Preliminary cost estimates up to $20.00 per ton indicate that the Altvater system is expensive. However, the system has environmental and technological advantages, including the following.

- o The Altvater system avoids the cost of replacing tractor-trailer tires.

- o The waste is reduced in size and homogenized during container loading, resulting in a more steady burn when firing and in better steam generation

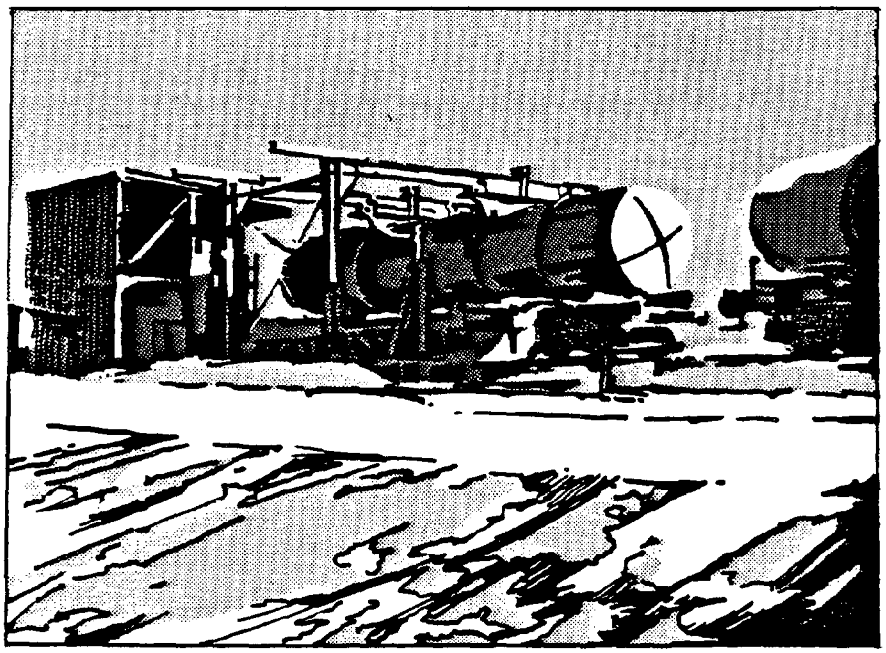
- o The containers are environmentally safe for refuse storage, thus conventional storage pits can be reduced in size by the amount of municipal solid waste stored in containers.

The central component of the system is a cylindrical, sealable solid waste container that holds up to 55 tons. It has helical ridges inside that pull refuse to the back by rotation during loading and guide it out during unloading. At the loading station, refuse trucks dump solid waste into a shearer from which the solid waste is loaded into the cylinders. When full weight is reached, the cylinders are hermetically sealed and evacuated, which eliminates anaerobic decomposition. The container is loaded onto rail flatcar, truck, or barge for transport to the receiving facility (see figure 26). Cylinders could also be floated in groups without a barge and towed to the landfill or incinerator. However, the manufacturer recommends the use of a barge in order to protect against damage to the container from underwater obstructions. Loading and unloading are facilitated by the cylindrical shape, which permits the container to be rolled.

Determination of Accessible Shipping Channels for the Standard Deck Barge

The standard deck barge selected in the above step draws 8 feet when fully loaded at 1,800 tons and 2 feet when empty. Twenty-four fully loaded trailers, each weighing 37.3 tons (a total weight of 895 tons), fit onto a standard deck barge. This is only 50 percent of the barge's capacity. A barge loaded to 50 percent of

Figure 26. Altvater system solid waste container



Source: Thyssen Engineering GMBH.

capacity would draw only 5 feet (2 feet + 0.5 (8 - 2)). With a 2-foot safety margin, the barge would need a channel 7 feet deep. The towboat draws 7 feet. With a 2-foot safety margin, a 9-foot channel is therefore required.

The channel characteristics of the Arthur Kill and the Raritan River are displayed schematically in figure 27. The US Army Corps of Engineers is responsible for dredging the Raritan up to New Brunswick. Corps projects currently maintain a channel at least 10 feet deep in the Raritan to and including the Red Root Reach. The Corps would maintain the remaining distance to the Edgeboro docking site if need was established and funds were available. The New York District Corps office felt that two or three barges per day would establish sufficient need to dredge the channel to a 9- or 10-foot depth; however, funds for dredging are currently limited, and a proposal to dredge shallower reaches to this depth would compete with other projects on a priority basis for available funds. Between Red Root and Sandy Point Reaches, the Raritan is already maintained to accommodate standard deck barges and towboats.

It should be noted that during severe winters the Raritan freezes, and no icebreaking program is in effect. No specific information is available from the Corps or the Coast Guard on the average number of days per year freezing occurs.

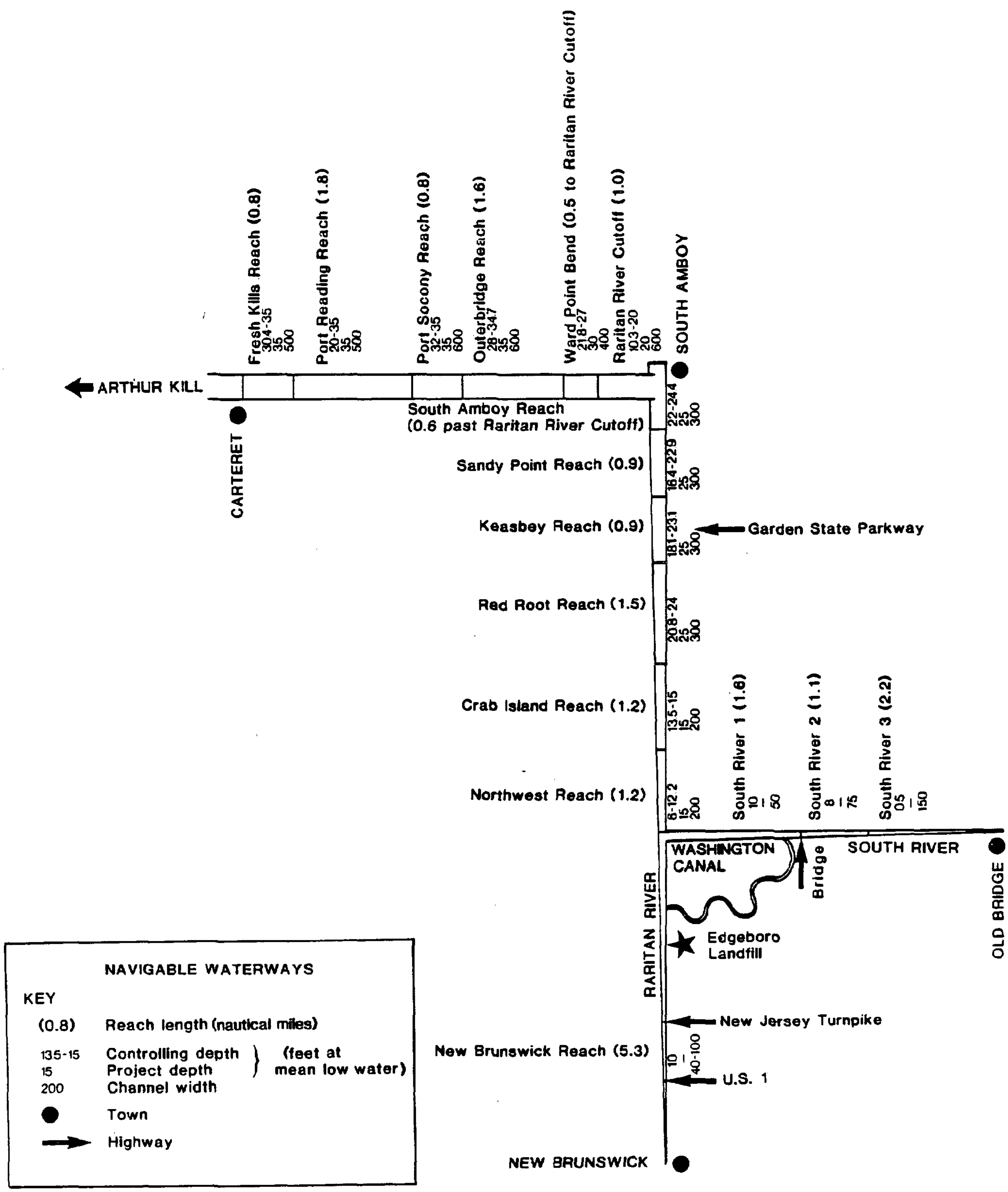
Location of Potential Barge Transfer Station Sites Along Accessible Channels

As a preliminary step, RG&H identified 20 possible riveredge sites for the location of barge transfer stations (see figure 28). Each of the 20 sites was characterized according to apparent land use, presence or absence of wetland and steep slope, quality of road access, and land uses in the immediate vicinity of the road approach. Site size was also noted. Selection was done primarily from USGS 7½' quadrangle maps of the area, but reference to NJDOT highway maps and NOAA ocean survey maps was also made. These results are summarized in table 36. The Township subsequently reviewed the 20 sites, further characterized them, and selected the more promising ones for site visits. The results of its analysis are summarized in figure 29. The Township concluded that of the 20 original sites, sites 10, 12, 16, and 19 are the preferred ones, although no one of them is clearly superior according to the criteria applied.

Selection of Location(s) for Barge Transfer Station(s) and Determination of Round-Trip Travel Times

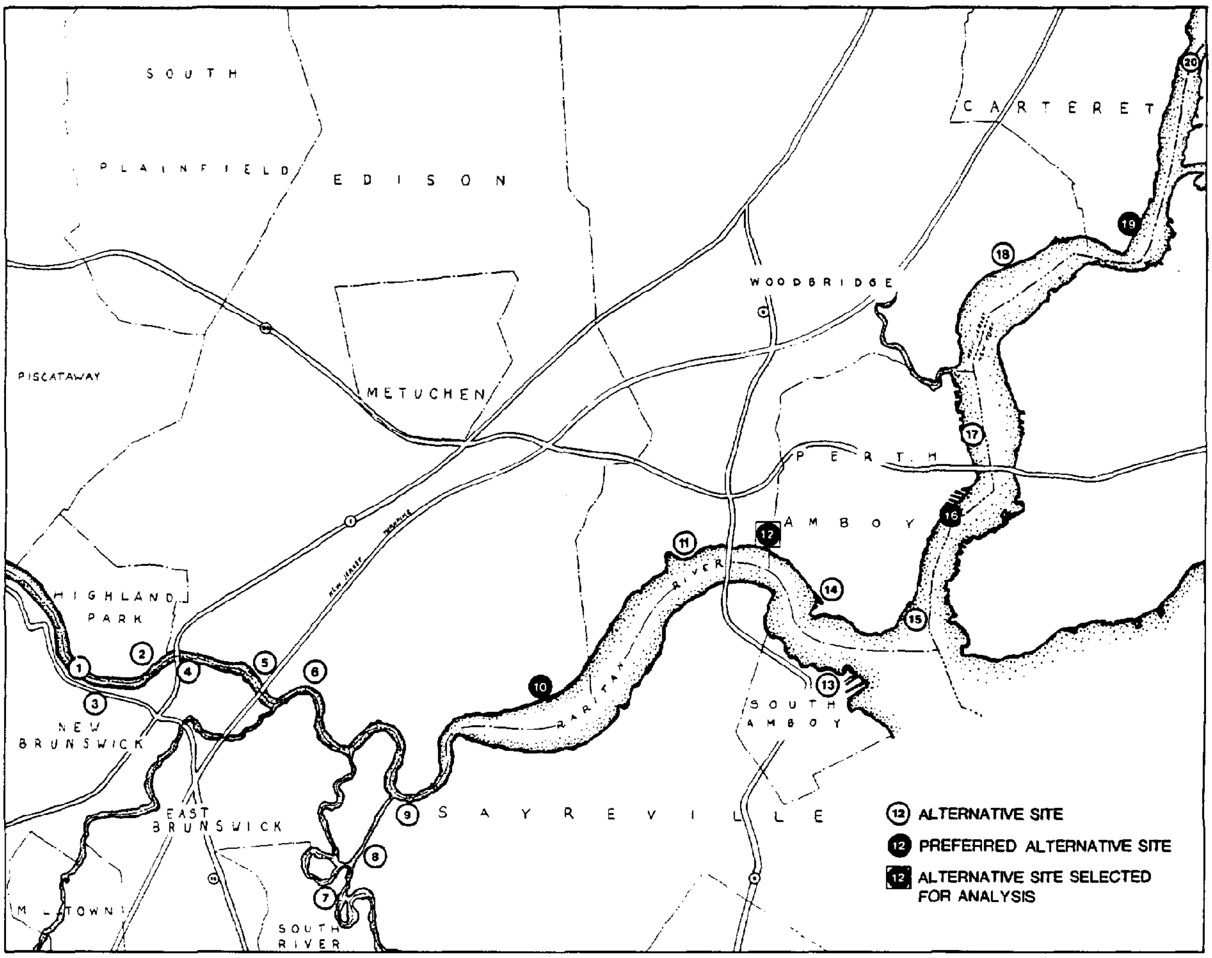
The four potential transfer station sites (10, 12, 16, and 19, figure 28) were located on the Middlesex County highway map and on the truck route map (figure 25). It was obvious from a cursory

Figure 27. Navigable waterways on the Raritan River and Arthur Kill



Source: NOAA National Ocean Survey Maps 12331 and 12332.

Figure 28. Truck-to-barge transfer station alternatives



Source: Rogers, Golden & Halpern.

Table 36. Possible sites for barge transfer stations and their characteristics

Site no. (see fig. 28)	Municipality	Site land use	Wetland	Steep slope	Area	Access	Access area
1	Highland Park	open	+	-	adequate	good	residential
2	Highland Park	open	+	-	adequate	good	residential
3	New Brunswick	industrial	-	-	small	not clear	institutional
4	New Brunswick	open	+/-	+/-	adequate	limited: enter NB Rt. 1 exit SB Rt. 1	open
5	Edison Twp.	industrial	+/-	+/-	adequate	good	industrial
6	Edison Twp.	industrial	-	-	adequate	good	industrial
7	South River	open	+	-	adequate	good	mixed
8	Sayreville	open	+/-	-	adequate	good	residential
9	Sayreville	industrial	+/-	-	adequate	good	mixed
10	Edison Twp.	military/ industrial	+	-	adequate	good	military/ industrial
11	Woodbridge Twp.	industrial	+/-	-	small	good	industrial
12	Woodbridge Twp./ Perth Amboy	industrial	-	-	adequate	good	industrial
13	South Amboy	industrial	-	-	adequate	good	mixed
14	Perth Amboy	industrial	-	-	adequate	good	mixed
15	Perth Amboy	industrial	-	-	small	good	mixed
16	Perth Amboy	industrial	-	-	adequate	good	mixed
17	Perth Amboy	industrial	-	-	adequate	good	industrial
18	Woodbridge Twp.	industrial	-	-	adequate	good	industrial
19	Carteret	industrial	-	-	adequate	good	mixed
20	Carteret	industrial	-	-	adequate	good	industrial

Source: Rogers, Golden & Halpern.

+ = Most of the site is of this type.
- = None of the site is of this type.
+/- = Part of the site is of this type.
NB = Northbound
SB = Southbound

Figure 29. Results of Township of East Brunswick analysis of truck-to-barge transfer station sites

LEGEND

- ● Acceptable
- ◐ Acceptable with limitations
- ○ Not acceptable
- X Not analyzed

Municipality	Site No.	LAND USAGE			ACCESSIBILITY				SITE CRITERIA				WATER ACCESS			ENVIRONMENTAL FACTORS			
		Current Land Use Compatibility	Current Zoning	Master Plan	Road Access	Condition of Road	Major Roadways	Access through Compatible Land Use	Existing Dock Facilities	Land Availability	Size of Site (3 acres)	Waterway Distance to RRF (1,000 ft)	Channel Depth	Channel Access (feet to shore)	Sedimentation/Siltation Factor	Absence of Steep Slopes	Absence of Wetlands	Absence of Flood Hazard	Wetlands Act/CAFRA
Highland Park	1	○	○	○	X	X	X	X	X	X	X	X	○	X	X	X	X	○	X
Highland Park	2	○	○	○	X	X	X	X	X	X	X	X	○	X	X	X	X	○	X
New Brunswick	3	○	○	○	X	X	X	X	X	X	X	X	○	X	X	X	X	●	X
New Brunswick	4	○	○	○	X	X	X	X	X	X	X	X	○	X	X	X	X	●	X
Edison	5	X	●	●	○	X	X	X	X	X	X	6.1	○	X	X	X	X	○	X
Edison	6	X	●	●	○	X	X	X	X	X	X	2.3	○	X	X	X	X	○	X
South River	7	X	○	○	X	X	X	X	X	X	X	X	○	X	X	X	X	●	X
Sayreville	8	X	○	○	X	X	X	X	X	X	X	X	○	X	X	X	X	◐	X
Sayreville	9	●	◐	○	●	●	◐	○	○	●	●	13.7	●	0	●	X	X	○	X
Edison	10	●	●	●	●	◐	●	●	●	●	●	24.3	●	60	◐	●	○	○	X
Woodbridge	11	●	●	●	●	X	●	●	○	○	X	25.5	●	0	●	●	◐	●	○
Woodbridge/Perth Amboy	12	●	●	●	●	X	●	●	●	◐	○	29.3	●	60	●	●	●	●	X
South Amboy	13	●	●	●	○	X	X	○	●	X	X	47.5	●	0	●	●	●	●	X
Perth Amboy	14	●	●	●	●	●	○	○	X	X	X	X	●	0	◐	X	X	●	X
Perth Amboy	15	○	○	○	X	X	X	X	X	X	X	X	●	200	●	X	X	●	X
Perth Amboy	16	●	●	●	●	●	◐	◐	●	●	●	60.8	●	0	●	●	●	●	X
Perth Amboy	17	●	●	●	○	X	X	X	X	X	X	X	●	80	◐	●	●	●	X
Woodbridge	18	●	●	●	○	X	X	X	X	X	X	X	●	0	●	●	●	●	X
Carteret	19	●	●	●	●	◐	◐	●	○	●	X	82.5	●	0	◐	●	●	●	X
Carteret	20	◐	●	●	○	●	◐	○	○	●	●	X	●	0	◐	●	●	●	X

Source: Township of East Brunswick.

examination of this juxtaposition that all but three of the municipalities south of the Raritan River are closer by road to the Edgeboro site than to any of the potential barge transfer station sites and that all but one north of the Raritan are closer to at least one of the four potential barge transfer station sites than to Edgeboro. The most direct road routes to the potential barge transfer sites from the centroids of the remaining 12 municipalities in the county were then determined. Based on visual scrutiny of these mapped routes, and a reexamination of the barge transfer station site characteristics (figure 29), Site 12 was selected as the location for a single barge transfer station serving 9 municipalities north of the Raritan and 2 to the south. Old Bridge Township was eliminated from the barge service area due to the shorter travel time to Edgeboro by truck. The round-trip distances and times of those 11 municipalities to Site 12 and to Edgeboro are compared in table 37.

Site 10 was not chosen because it consists of much wetland area. Site 16 was not selected because access to it is through urbanized areas of Perth Amboy. Site 19 was eliminated because its service area included only Carteret, Perth Amboy, and Woodbridge Township.

It should be understood that Site 12 has been selected only to provide a focus for subsequent cost and impact analyses. In no way should this selection of Site 12 be interpreted as a final site recommendation.

The barge and truck service areas and barge and highway routes to Edgeboro and Site 12 are displayed in figure 30.

Estimation of Savings in Solid Waste Transportation Costs Due to the Use of the Barge Transfer Station

In this step, information developed in various previous steps is brought together to calculate the potential cost savings due to shorter solid waste transportation distances from municipalities in the barge service area (see figure 30). Table 38 displays the information needed for this calculation and the results.

The results of this analysis show that a maximum of about $1.1 million per year in trucking costs can be saved by carrying 2,000 tons per day from 11 municipalities to a barge transfer station instead of trucking directly to the Edgeboro site. In the next step these potential savings will be compared to the cost of the barge alternative.

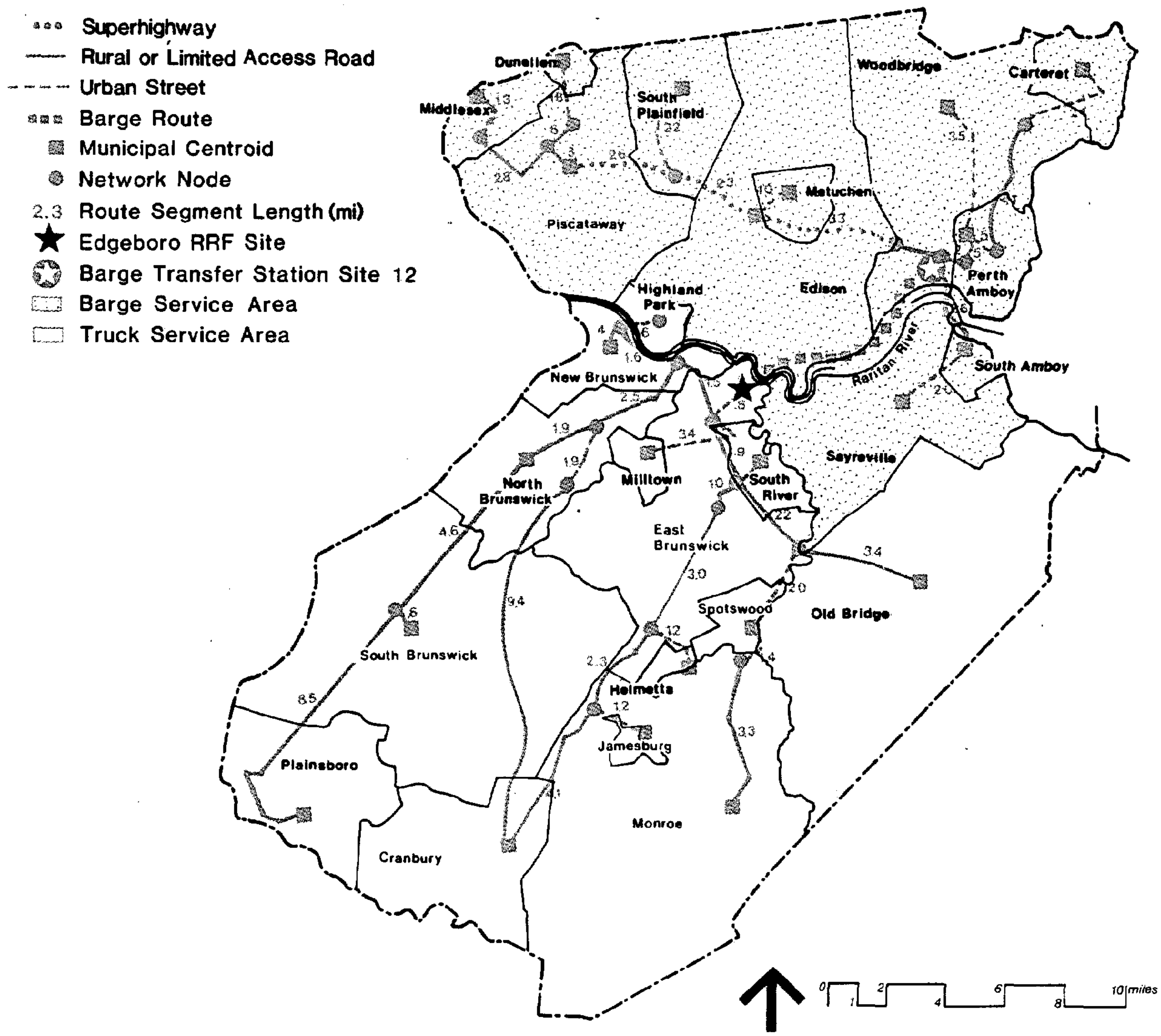
Table 37. Comparison of round-trip distances and travel times from municipal solid waste centroids to the Edgeboro site and to the barge transfer station--Site 12

	Distance to barge transfer station--Site 12 (mi)				Time to barge transfer station--Site 12 (min)				Time to Edgeboro* (min)
	One-way			Round-trip (Total)	One-way			Round-trip (Total)	Round-trip (Total)
	Urban street	Rural or limited access road	Super-highway		Urban street	Rural or limited access road	Super-highway		
Carteret	4.2	4.1	--	16.6	12.6	7.0	--	39.2	66.8
Dunellen	2.0	2.4	8.1	25.0	6.0	4.1	8.8	37.8	51.6
Edison	0.2	1.5	3.2	9.8	0.6	2.6	3.5	13.4	28.4
Metuchen	1.2	1.5	3.2	13.8	3.6	2.6	3.5	19.4	34.2
Middlesex	1.5	4.6	8.1	28.2	4.5	7.8	8.8	42.2	57.4
Perth Amboy	0.9	--	--	1.8	2.7	--	--	5.4	36.0
Piscataway	0.2	1.5	8.1	19.6	0.6	2.6	8.8	24.0	39.0
Sayreville	2.2	2.6	--	9.6	6.6	4.4	--	22.0	38.4
South Amboy	0.2	2.6	--	5.6	0.6	4.4	--	10.0	51.2
South Plainfield	2.4	1.5	5.5	18.8	7.2	2.6	6.0	31.6	46.4
Woodbridge	4.5	--	--	9.0	13.5	--	--	27.0	37.8

Source: Rogers, Golden & Halpern.

*From table 35.

Figure 30. Routes for barging and trucking solid waste to resource recovery facility site



Source: Rogers, Golden & Halpern; Middlesex County, 1975; and US Geological Survey, 1970.

Table 38. Total potential savings due to time saved transporting solid waste by truck to barge transfer station—Site 12

Municipality	Total solid waste 1990* (TPD)	Truck trips per day at 5 tons per trip	Round-trip time to Edgeboro** (min)	Round-trip time to barge transfer station--Site 12*** (min)	Time saved per trip using barge transfer station (min)	Time saved per year using barge transfer station**** (hr)	Total dollars saved per year(potential) at $32/hr*****
Carteret	153	31	66.8	39.2	27.6	4,278	$ 136,896
Dunellen	23	5	51.6	37.8	13.8	345	11,040
Edison	624	125	28.4	13.4	15.0	9,375	300,000
Metuchen	51	11	34.2	19.4	14.8	814	26,048
Middlesex	128	26	57.4	42.2	15.2	1,976	63,232
Perth Amboy	226	45	36.0	5.4	30.6	6,885	220,320
Piscataway	148	30	39.0	24.0	15.0	2,250	72,000
Sayreville	53	11	38.4	22.0	16.4	902	28,864
South Amboy	8	2	50.4	10.0	40.4	404	12,928
South Plainfield	72	15	46.4	31.6	14.8	1,110	35,520
Woodbridge	471	95	37.8	27.0	10.8	5,088	162,816
Total	1,957	396	--	--	--	33,427	1,069,664

* From table 33.
** From table 35.
*** From table 37.
**** Time saved per trip x truck trips per day x 300 days/yr 60 min/hr.
***** From table 34.

Sources: Middlesex County Planning Board; Rogers, Golden & Halpern.

Comparison of Costs and Savings of the Barge System

The average daily solid waste load from all Middlesex County municipalities within the barge service area is about 2,000 tons per day. Part of this is destined for incineration in the RRF but most of it will be landfilled. The cost of barging 2,000 tons per day from a barge transfer station (Site 12, figure 28) on the Keasbey Reach of the Raritan is presented in table 39.

The total annual cost of barging 2,000 tons per day of solid waste from a barge transfer station on the Raritan to the Edgeboro RRF/landfill is estimated to be $9.8 million. Only 11 percent of this cost is offset by the savings (see table 38) obtained due to lower truck transportation costs.

It should be recalled that the Raritan freezes over in periods of severe cold. During these periods solid waste could not be barged. Since the barge transfer station has no significant storage capacity, the solid waste would have to be trucked to the Edgeboro RRF/landfill. The municipalities in the barge service area closest to Edgeboro could truck solid wastes there directly at additional expense for crew overtime. Other municipalities in the service area could truck solid waste to the barge transfer site for compaction into the 25-ton trailers, which would then be road-hauled to the Edgeboro site. Extra tractors would have to be rented for this.

Table 39. Summary of costs of barging 2,000 TPD of solid waste from barge transfer station (Site 12) to the Edgeboro site

	Cost (x$1,000)			
	Initial capital	Amortized capital	Annual O&M	Total annual
Truck-to-barge transfer station	$37,990	$3,690	$2,000	$5,690
Barge hauling components* (5.5 mi one-way)	--	--	--	526
Unloading station	19,500	1,900	1,730	3,630
Total	57,490	5,480	3,730	9,736

Source: Greeley and Hansen.

*Amortized capital costs and annual O&M costs of barges and towboats are included in leasing costs, the total amount of which is represented by the total annual cost.

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The following sources were used to prepare this report. Additional unpublished data were supplied by the contractors, the Township of East Brunswick, and Middlesex County. Sources of information used in the appendices are listed at the end of each appendix.

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APPENDIX A. ENDANGERED AND THREATENED SPECIES: FEDERAL AND STATE OF NEW JERSEY LISTINGS

This appendix contains (1) the US Fish and Wildlife Service list of endangered and threatened species common to New Jersey (October 1980) and (2) the NJDEP list of endangered, threatened, peripheral, declining, undetermined, and extirpated wildlife species in the state (March 29, 1979). The latter is a reproduction of the official list from the Division of Fish, Game and Shellfisheries, Endangered and Nongame Species Project. As of this writing, there have been no changes to the list.

FEDERALLY LISTED ENDANGERED AND THREATENED SPECIES IN NEW JERSEY

Common Name	Scientific Name	Status **	Distribution
FISHES:			
Sturgeon, shortnose*	Acipenser brevirostrum	E	Hudson and Delaware Rivers plus other Atlantic coastal rivers
REPTILES:			
Turtle, green*	Chelonia mydas	T	Oceanic summer visitor coastal waters
Turtle, hawksbill*	Eretmochelys imbricata	E	Oceanic summer visitor coastal waters
Turtle, leatherback*	Dermochelys coriacea	E	Oceanic summer resident coastal waters
Turtle, loggerhead*	Caretta caretta	T	Oceanic summer resident coastal waters rarely nests: Cape May and Atlantic Counties
Turtle, Atlantic Ridley*	Lepidochelys kempii	E	Oceanic summer resident coastal waters
BIRDS:			
Eagle, bald	Haliaeetus leucocephalus	E	Entire state
Falcon, American peregrine	Falco peregrinus anatum	E	Entire state - re-establishment to former breeding range in progress
Falcon, Arctic peregrine	Falco peregrinus tundrius	E	Entire state migratory - no nesting
MAMMALS:			
Cougar, eastern	Felis concolor cougar	E	Entire state - probably extinct
Whale, blue*	Balaenoptera musculus	E	Oceanic
Whale, finback*	Balaenoptera physalus	E	Oceanic
Whale, humpback*	Megaptera novaeangliae	E	Oceanic
Whale, right*	Eubalaena spp. (all species)	E	Oceanic
Whale, sei*	Balaenoptera borealis	E	Oceanic
Whale, sperm*	Physeter catodon	E	Oceanic
MOLLUSKS:			
None			
PLANTS:			
None			

Source: Office of Endangered Species, US Fish and Wildlife Service, 1980.

* Except for sea turtle nesting habitat, principal responsibility for these species is vested with the National Marine Fisheries Service.

** E = Endangered, T = threatened.

ENDANGERED, THREATENED, PERIPHERAL, DECLINING, UNDETERMINED AND EXTIRPATED

WILDLIFE SPECIES IN NEW JERSEY

- Official List -

STATE OF NEW JERSEY

DEPARTMENT OF ENVIRONMENTAL PROTECTION

DIVISION OF FISH, GAME AND SHELLFISHERIES

Prepared by:

Endangered and Nongame Species Project

Russell A. Cookingham
Director

March 29, 1979

Nomenclature References

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AMPHIBIANS AND REPTILES

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DEFINITIONS

ENDANGERED	-	An endangered species is one whose prospects for survival within the state are in immediate danger due to one or many factors - a loss of or change in habitat, over exploitation, predation, competition, disease. An endangered species requires immediate assistance or extinction will probably follow.
THREATENED	-	May become endangered if conditions surrounding the species begin to or continue to deteriorate.
PERIPHERAL	-	A species whose occurence in New Jersey is at the extreme edge of its present natural range.
UNDETERMINED	-	A species about which there is not enough information available to determine the status.
DECLINING	-	A species which has exhibited a continued decline in population numbers over the years.
EXTIRPATED	-	A species that formerly occurred in New Jersey, but is not now known to exist within the state.
SPECIAL CASE	-	Species not known to nest regularly in New Jersey (marine reptiles) but that do occur off our shores - some occurring with regularity close to our shores or in our bays (marine reptiles and mammals).

ENDANGERED SPECIES IN NEW JERSEY

FISH

Shortnose Sturgeon	Acipenser brevirostrum

AMPHIBIANS

Tremblay's Salamander	Ambystoma tremblayi
Blue-spotted Salamander	Ambystoma laterale
Eastern Tiger Salamander	Ambystoma tigrinum
Pine Barrens Treefrog	Hyla andersoni
Southern Gray Treefrog	Hyla chrysoscelis

REPTILES

Bog Turtle	Clemmys muhlenbergi
Timber Rattlesnake	Crotalus horridus horridus

BIRDS

b Bald Eagle	Haliaeetus leucocephalus
Peregrine Falcon	Falco peregrinus
b Osprey	Pandion haliaetus
b Cooper's Hawk	Accipter cooperii
b Least Tern	Sterna albifrons
b Black Skimmer	Rynchops niger

MAMMALS

Indiana Bat	Myotis sodalis

SPECIAL CASE

MARINE REPTILES

Atlantic Hawksbill	Eretmochelys imbricata
Atlantic Loggerhead	Caretta caretta
Atlantic Ridley	Lepidochelys kempi
Atlantic Leatherback	Dermochelys coriacea

MARINE MAMMALS

Sperm Whale	Physeter macrocephalus
Blue Whale	Balaenoptera musculus
Fin Whale	Balaenoptera physalus
Sei Whale	Balaenoptera borealis
Humpback Whale	Megaptera novaeangliae
Atlantic Right Whale	Eubalaena glacialis

b = breeds in New Jersey

THREATENED SPECIES IN NEW JERSEY

FISH

Atlantic Sturgeon	*Acipenser oxyrhynchus*
American Shad	*Alosa sapidissima*
Brook Trout (native)	*Salvelinus fontinalis*
Atlantic Tomcod	*Microgadus tomcod*

AMPHIBIANS

Long-tailed Salamander	*Eurycea longicauda*
Eastern Mud Salamander	*Pseudotriton montanus*

REPTILES

Wood Turtle	*Clemmys insculpta*
Corn Snake	*Elaphe guttata*
Northern Pine Snake	*Pituophis melanoleucus melanoleucus*

BIRDS

b Pied-billed Grebe	*Podilymbus podiceps*
b Great Blue Heron	*Ardea herodias*
b Red-shouldered Hawk	*Buteo lineatus*
b Marsh Hawk	*Circus cyaneus* [1]
Merlin	*Falco columbarius*
b Upland Sandpiper (Plover)	*Bartramia longicauda*
b Roseate Tern	*Sterna dougallii*
b Barred Owl	*Strix varia*
b Short-eared Owl	*Asio flammeus* [1]
b Red-headed Woodpecker	*Melanerpes erythrocephalus*
b Cliff Swallow	*Petrochelidon pyrrhonota* [1]
Short-billed Marsh Wren	*Cistothorus platensis*
b Bobolink	*Dolichonyx oryzivorus* [1]
b Savannah Sparrow	*Passerculus sandwichensis* [1]
b Ipswich Sparrow	*Passerculus sandwichensis princeps*
b Grasshopper Sparrow	*Ammodramus savannarum* [1]
Henslow's Sparrow	*Ammodramus henslowii*
b Vesper Sparrow	*Pooecetes gramineus* [1]

SPECIAL CASE

MARINE REPTILES

Atlantic Green Turtle	*Chelonia mydas*

b = breeds in New Jersey

1 Status designation applicable to breeding population only

PERIPHERAL SPECIES IN NEW JERSEY

FISH

White Shark	*Carcharodon carcharias*
Smooth Hammerhead	*Sphyrna zygaena*
Thorny Skate	*Raja radiata*
Spotted Eagle Ray	*Aetobatus narinara*
Ladyfish	*Elops saurus*
Tarpon	*Megalops atlantica*
Snakefish	*Trachinocephalus myops*
Haddock	*Melanogrammus aeglefinus*
White Hake	*Urophycis tenuis*
Halfbeak	*Hyporhamphus unifasciatus*
Houndfish	*Tylosurus crocodilus*
Bluespotted Cornetfish	*Fistularia tabacaria*
Longspine Snipefish	*Macrorhamphosus scolopax*
Gag	*Mycteroperca microlepis*
Snowy Grouper	*Epinephelus niveatus*
Warsaw Grouper	*Epinephelus nigritus*
Glasseye Snapper	*Priacanthus cruentatus*
Bigeye	*Priacanthus arenatus*
Short Bigeye	*Pristigenys alta*
Cobia	*Rachycentron canadum*
Bluerunner	*Caranx crysos*
Crevalle Jack	*Caranx hippos*
Horse-eye Jack	*Caranx latus*
Round Scad	*Decapterus punctatus*
Leatherjacket	*Oligoplites saurus*
Bigeye Scad	*Selar crumenophthalmus*
Lookdown	*Selene vomer*
Greater Amberjack	*Seriola dumerili*
Banded Rudderfish	*Seriola zonata*
Florida Pompano	*Trachinotus carolinus*
Permit	*Trachinotus falcatus*
Palometa	*Trachinotus glaucus*
Rough Scad	*Trachurus lathami*
Atlantic Moonfish	*Vomer setapinnis*
Dolphin	*Coryphaena hippurus*
Spotfin Mojarra	*Eucinostomus argenteus*
Gray Snapper	*Lutjanus griseus*
Spottail Pinfish	*Diplodus holbrooki*
Pinfish	*Lagodon rhomboides*
Spotted Seatrout	*Cynoscion nebulosus*
Banded Drum	*Larimus fasciatus*
Atlantic Croaker	*Micropogon undulatus*
Red Drum	*Sciaenops ocellata*
Red Goatfish	*Mullus auratus*

PERIPHERAL SPECIES IN NEW JERSEY

FISH

Spotted Goatfish	Psuedupeneus maculatus
Atlantic Spadefish	Chaetodipterus faber
Foureye Butterflyfish	Chaetodon capistratus
Spotfin Butterflyfish	Chaetodon ocellatus
Banded Butterflyfish	Chaetodon striatus
Sergeant Major	Abudefduf saxatilus
Atlantic Threadfin	Polydactylus octonemus
Rock Gunnel	Pholis gunnellus
Snake Blenny	Lumpenus lumpretaeformis
Fat Sleeper	Dormitator maculatus
Atlantic Cutlassfish	Trichiurus lepturus
Frigate Mackerel	Auxis thazard
King Mackeral	Scomberomorus cavalla
Spanish Mackerel	Scomberomorus maculatus
Barbfish	Scorpaena brasiliensis
Spotted Scorpionfish	Scorpaena plumieri
Scorpionfish	Scorpaena isthmensis
Flounder	Bothus robinsi
Flying Gurnard	Dactylopterus volitans
Orange Filefish	Aluterus schoepfi
Gray Triggerfish	Balistes capriscus
Planehead Filefish	Monacanthus hispidus
Trunkfish	Lactophrys trigonus
Smooth Trunkfish	Lactophrys triqueter
Scrawled Cowfish	Lactophrys quadricornis
Smooth Puffer	Lagocephalus laevigatus
Web Burrfish	Chilomycterus antillarum
Striped Burrfish	Chilomycterus schoepfi

BIRDS

Migratory birds are not listed, as many appear both spring and fall in New Jersey.

MAMMALS

Porcupine	Erethizon dorsatum

SPECIAL CASE

MARINE MAMMALS

Harp Seal	Pagophilus groenlandicus
Hooded Seal	Cystophora cristata
Gray Seal	Halichoerus grypus
Beluga Whale	Delphinapterus leucas

DECLINING SPECIES IN NEW JERSEY

FISH

Northern Kingfish	Menticirrhus saxatilis
Northern Puffer	Sphaeroides maculatus

AMPHIBIANS

Marbled Salamander	Ambystoma opacum
Spotted Salamander	Ambystoma maculatum
Four-toed Salamander	Hemidactylium scutatum
Northern Spring Salamander	Gyrinophilus porphyriticus porphyriticu
Northern Red Salamander	Pseudotriton ruber ruber
Eastern Spadefoot Toad	Scaphiopus holbrooki holbrooki

REPTILES

Eastern Hognose Snake	Heterodon platyrhinos

BIRDS

Red-necked Grebe	Podiceps grisegena
b Yellow-crowned Night Heron	Nyctanassa violacea
b American Bittern	Botaurus lentiginosus
b Least Bittern	Ixobrychus exilis
Baird's Sandpiper	Calidris bairdii
Marbled Godwit	Limosa fedoa
Hudsonian Godwit	Limosa haemastica
b Common Tern	Sterna hirundo
Razorbill	Alca torda
Dovekie	Alle alle
b Whip-poor-will	Caprimulgus vociferous
b Least Flycatcher	Empidonax minimus[1]
b Horned Lark	Eremophila alpestris[1]
b Purple Martin	Progne subis
b White-eyed Vireo	Vireo griseus
b Warbling Vireo	Vireo gilvus
b Yellow-breasted Chat	Icteria virens
b Hooded Warbler	Wilsonia citrina
b Eastern Meadowlark	Sturnella magna[1]

b = Breeds in New Jersey

1 Status designation applicable to breeding population only.

UNDETERMINED SPECIES IN NEW JERSEY

FISH

Shortfin Mako	Isurus oxyrinchus
Bull Shark	Carcharhinus leucas
Tiger Shark	Galeocerdo cuvieri
Clearnose Skate	Raja eglanteria
Roughtail Stingray	Dasyatis centroura
Atlantic Stingray	Dasyatis sabina
Bluntnose Stingray	Dasyatis sayi
Spiny Butterfly Ray	Gymnura altavela
Smooth Butterfly Ray	Gymnura micrura
Bullnose Ray	Myliobatis freminvillei
Round Herring	Etrumeus teres
Atlantic Thread Herring	Opisthonema oglinum
Silver Anchovy	Anchoviella eurystole
Rainbow Smelt	Osmerus mordax
Bridle Shiner	Notropis bifrenatus
Ironcolor Shiner	Notropis chalybaeus
Bluntnose Minnow	Pimephales notatus
Fourbeard Rockling	Enchelyopus cimbrius
Atlantic Cod	Gadus morhua
Ocean Pout	Macrozoarces americanus
Spotfin Killifish	Fundulus luciae
Rough Silverside	Membras martinica
Threespine Stickleback	Gasterosteus aculeatus
Ninespine Stickleback	Pungitius pungitius
Shield Darter	Percina peltata
Atlantic Pomfret	Brama brama
Striped Blenny	Chasmodes bosquianus
Crested Blenny	Hypleurochilus geminatus
Feather Blenny	Hypsoblennius hentzi
Darter Goby	Gobionellus boleosoma
Highfin Goby	Gobionellus oceanicus
Seaboard Goby	Gobiosoma ginsburgi
Sharksucker	Echeneis naucrates
Whitefin Sharksucker	Echeneis nuecratoides
Little Tuna	Euthynnus alletteratus
Chub Mackeral	Scomber colias
Harvestfish	Peprilus alepidotus
Sea Raven	Hemitripterus americanus
Grubby	Myoxocephalus aeneus
Bay Whiff	Citharichthys spilopterus
Fourspot Flounder	Paralichthys oblongus
Yellowtail Flounder	Limanda ferruginea

AMPHIBIANS

Jefferson Salamander	Ambystoma jeffersonianum
Silvery Salamander	Ambystoma platineum
Mountain Dusky Salamander	Desmognathus ochrophaeus
Upland Chorus Frog	Psuedacris triseriata feriarum
Carpenter Frog	Rana virgatipes
Northern Cricket Frog	Acris crepitans crepitans

REPTILES

Spotted Turtle	Clemmys guttata
Map Turtle	Graptemys geographica
Red-bellied Turtle	Chrysemys rubriventris
Midland Painted Turtle	Chrysemys picta marginata
Five-lined Skink	Eumeces fasciatus
Ground Skink	Leiolopisma laterale
Queen Snake	Natrix septemvittata
Eastern Smooth Earth Snake	Virginia valeriae
Northern Black Racer	Coluber constrictor constrictor
Eastern Smooth Green Snake	Opheodrys vernalis vernalis
Black Rat Snake	Elaphe obsoleta obsoleta
Eastern King Snake	Lampropeltis getulus getulus
Northern Scarlet Snake	Cemophora coccinea copei
Northern Copperhead	Agkistrodon contortrix mokasen
Eastern Worm Snake	Carphophis amoenus amoenus

BIRDS

b Black Duck	Anas rubripes
b Ruddy Duck	Oxyura jamaicensis
b Sharp-shinned Hawk	Accipter gentilis[1]
b King Rail	Rallus elegans
Yellow Rail	Coturnicops noveboracensis
b Black Rail	Laterallus jamaicensis
b American Coot	Fulica americana[1]
b Piping Plover	Charadrius melodus
b Common Snipe	Capella gallinago[1]
b Long-eared Owl	Asio otus
b Eastern Bluebird	Sialia sialis
Loggerhead Shrike	Lanius ludovicianus

MAMMALS

Water Shrew	Sorex palustris
Smokey Shrew	Sorex fumeus
Long-tailed Shrew	Sorex dispar
Least Shrew	Cryptotis parva
Hairy-tailed Mole	Parascalops breweri
Star-nosed Mole	Condylura cristata
Keen Myotis	Myotis keenii
Small-footed Myotis	Myotis sublatus
Silver-haired Bat	Lasionycteris noctivagans
Eastern Pipistrel	Pipistrellus subflavus
Hoary Bat	Lasiurus cinereus

b = Breeds in New Jersey

1 Status designation applicable to breeding population only

UNDETERMINED SPECIES IN NEW JERSEY

Southern Flying Squirrel	*Glaucomys volans*
Marsh Rice Rat	*Oryzomys palustris*
Deer Mouse	*Peromyscus maniculatus*
Eastern Wood Rat	*Neotoma floridana*
Southern Bog Lemming	*Synaptomys cooperi*
Meadow Jumping Mouse	*Zapus hudsonius*
Woodland Jumping Mouse	*Napaeozapus insignis*
Bobcat	*Lynx rufus*

MARINE MAMMALS

Dense Beaked Whale	*Mesoplodon densirostris*
Gulfstream Beaked Whale	*Mesoplodon gervaisi*
Antillean Beaked Whale	*Mesoplodon europaeus*
True's Beaked Whale	*Mesoplodon mirus*
Cuvier's Beaked Whale	*Ziphius cavirostris*
Pygmy Sperm Whale	*Kogia breviceps*
Dwarf Sperm Whale	*Kogia simus*
Cuvier Dolphin	*Stenella frontalis*
Spotted Dolphin	*Stenella plagiodon*
Striped Dolphin	*Stenella coeruleoalba*
Common Dolphin	*Delphinus delphis*
Atlantic White-side Dolphin	*Lagenorhynchus acutus*
Atlantic Killer Whale	*Orcinus orca*
Risso's Dolphin	*Grampus griseus*
Long-finned Pilot Whale (Blackfish)	*Globicephala melaena*
Short-finned Pilot Whale	*Globicephala macrorhyncus*
Atlantic Harbor Porpoise	*Phocoena phocoena*
Minke Whale	*Balaenoptera acutorostrata*

EXTIRPATED SPECIES IN NEW JERSEY

FISH

Longnose Gar	Lepisosteus osseus

BIRDS

b Wilson's Plover	Charadrius wilsonia[1]
Eskimo Curlew	Numenius borealis
b Northern Parula	Parula americana[1]

MARINE MAMMALS

Gray Whale	Eschrichtius robustus

MAMMALS

Gray Wolf	Canis lupus
Mountain Lion	Felis concolor
Snowshoe Hare	Lepus americanus

b = Breeds in New Jersey

[1] Status designation applicable to breeding population only

5/2/79
hb

SOURCES

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Tanner, Bill. 1981. Engineer, East Brunswick Township: personal communication, June 1981:

APPENDIX B.
PERMITS AND AGENCY REVIEWS REQUIRED FOR A RESOURCE RECOVERY FACILITY

Before construction on a resource recovery facility can begin, or before the facility can be operated, several applications for permits and certificates must be approved by local, state, and federal agencies. The permitting process not only allows for government review of proposed projects, but through public hearings incorporated in the permitting process, citizen participation and input is encouraged. An effort to thoroughly investigate environmental aspects of construction and operation of an RRF can take several years. A complete and detailed application and a close working relationship with the government agencies aids in speeding the process.

The following permits, certificates, standards, approvals, and other issues are discussed in this section:

Master Permit Information Form

Solid Waste Facility Registration

Board of Public Utilities Rate Approval

Air Quality Permits

- Permit to Construct, Install, or Alter Control Apparatus or Equipment
- Certificate to Operate or Control Apparatus or Equipment
- Prevention of Significant Deterioration Permit
- New Source Performance Standards
- National Emissions Standards for Hazardous Air Pollutants

Water Quality Permits

- Treatment Works Approval
- NJ Pollutant Discharge Elimination System
- National Pollutant Discharge Elimination System
- Water Diversion Permit
- Well Drilling Permit

Flood Zone Permits

- Stream Encroachment Permit
- Waterfront Development Permit
- Grant, Lease or License Permit

Soil Erosion and Sediment Control Plan Certification

Plan Release--High Rise and Hazardous Structures

Notice of Proposed Construction or Alteration

NJ Department of Transportation Permits

Access Driveway Permit
Bridge Attachment Permit
Highway Occupancy Permit
Utility Opening Permit

Solid Waste Facility Registration

Transfer Station

US Army Corps of Engineers Permits

Discharge of Dredged Materials Permit (Section 404)
Building on a Waterway Permit (Section 10)
Water Quality Certificate

Local Permits

Site Plan Review
Public Water Use Approval
Sewer Plans and Tie-in Approval
Building Permit
Certificate of Occupancy

General State Permits--Critical Lands

Coastal Area Facility Review Act Permit
Delaware and Raritan Canal Commission Approval
Hackensack Meadowlands Development Commission Approval
Pinelands Environmental Council Approval

Noise Control

Fogging and Condensation on Roads and Highways

Historical and Archaeological Siting

These permits and agency reviews are listed in a relative order of importance. However, each permit is important in its own right, and denial of approval can prevent construction.

MASTER PERMIT INFORMATION FORM

To ease some of the confusion surrounding the entire permitting process, the Office of Business Advocacy (NJOBA) in the Department of Labor and Industry has developed a Master Permit Information Form. This form will identify NJDEP permits and indicate whether it is necessary to contact the Department of Transportation (NJDOT), the Department of Community Affairs (NJDCA), the Department of Health (NJDH), and/or the Department of Agriculture (NJDA) for their permitting and application requirements. The form contains questions about the proposed project and its relation to air and water quality, solid waste, and historical preservation sites.

Within two weeks the applicant will receive a letter identifying the NJDEP permits necessary, application forms, instructions, and the names of individuals within the department to contact for assistance. When the need to contact NJDOT, NJDCA, NJDH or NJDA is indicated, contact the department directly. For the Master Permit Information form, contact:

Office of Business Advocacy
P.O. Box 2766
Trenton, NJ 08625

SOLID WASTE FACILITY REGISTRATION

Registration of new solid waste collection and disposal facilities is required under the Solid Waste Management Act (NJAC 7:26-1 et seq.). A solid waste facility is any system, site, equipment, or building that is used for the storage, collection, processing, transfer, transportation, separation, recycling, recovery, or disposal of solid waste. Both the resource recovery facility and the transfer stations would come under this registration requirement. The regulations also define and describe exactly what solid waste is. Certain waste streams are handled under different sections of the regulations, and some are covered by separate regulations altogether.

In reviewing registration statements for new facilities, NJDEP must consider the comprehensive regional Solid Waste Management Plan. The facility's need, site location, and estimated cost must be in the plan. All counties to be served by the new facility must determine that it is consistent with their district plans.

Before the application process begins, the NJ Solid Waste Administration (NJSWA) suggests a preapplication meeting. In the building of these facilities, NJSWA acts as the lead agency and informs the applicant of other permits that may be necessary for the project's approval. Information needed at this preapplication meeting includes type and description of the proposed facility, types and rates of waste to be accepted, and an outline of area to be served by the facility. The meeting is informal and nonbinding; it is meant to save the applicant time and money.

A final application for Solid Waste Facility Registration is more comprehensive and includes the standard NJDEP form, the NJSWA supplemental form, project-specific engineering requirements, and an application fee. Part of the application asks for other submitted and/or approved permits for the project. Because the NJSWA will not grant registration until all other applications have been approved, it is suggested that all other applications be submitted before the NJSWA application.

For larger solid waste facility projects, an Environmental Impact Statement (EIS) is often required. The NJSWA has developed guidelines to ensure that the EIS is complete. A complete description of the project, including purpose, services, location, justification of need, and project design is required. Conformance to Regional Solid Waste Management Plans is important and should be included in the EIS. An environmental analysis and description prior to project implementation and a theoretical description of the effects of project operation are also necessary. Specific information on land, man-made resources, water, air, aesthetics, and waste flow are to be included. Abnormal environmental impacts must also be considered and included in the EIS. Discussion should include the kinds and magnitudes of adverse impacts that cannot be reduced to an acceptable level. Alternatives should also be considered. A complete analysis of the short- and long-term use and productivity of the surrounding environment should be included in the EIS.

After application has been made and the NJSWA has determined the application complete, all counties and municipalities located within a one-mile radius of the proposed facility will be notified. Copies of the application will be available for public review. An in-house meeting is held with NJSWA and members of the affected municipalities, followed by public hearings. NJSWA will not approve the plans without first holding a public hearing in order to receive public review and comment. Public notice of the hearing must appear in at least two newspapers of general circulation in the area affected by the plans.

The entire application-permitting process takes approximately one and one-half years. Depending on the nature of the facility, closer inspection may be required. Several measures may facilitate the process on which facility registration depends: preapplication meetings with the NJSWA to confirm the information required, submitting documented information, and similar conscientious application procedures with other divisions and departments.

If a Disruption of Solid Waste permit is required, the general Solid Waste Facility Registration application will cover both permits. Additional information required for a disruption permit consists of a narrative report describing the quantity of material to be excavated, the manner and location of redeposition, and measures taken to mitigate dust, fires, etc., during construction. The permitting process for a Disruption of Solid Waste application can take from 30 days to a year, depending upon the size of the disruption. These two permits can be reviewed concurrently by the Solid Waste Administration.

For information about the entire solid waste permitting process, contact:

Bureau of Technical Services
Division of Solid Waste Administration
Department of Environmental Protection
32 East Hanover Street
Box 2807
Trenton, NJ 08625

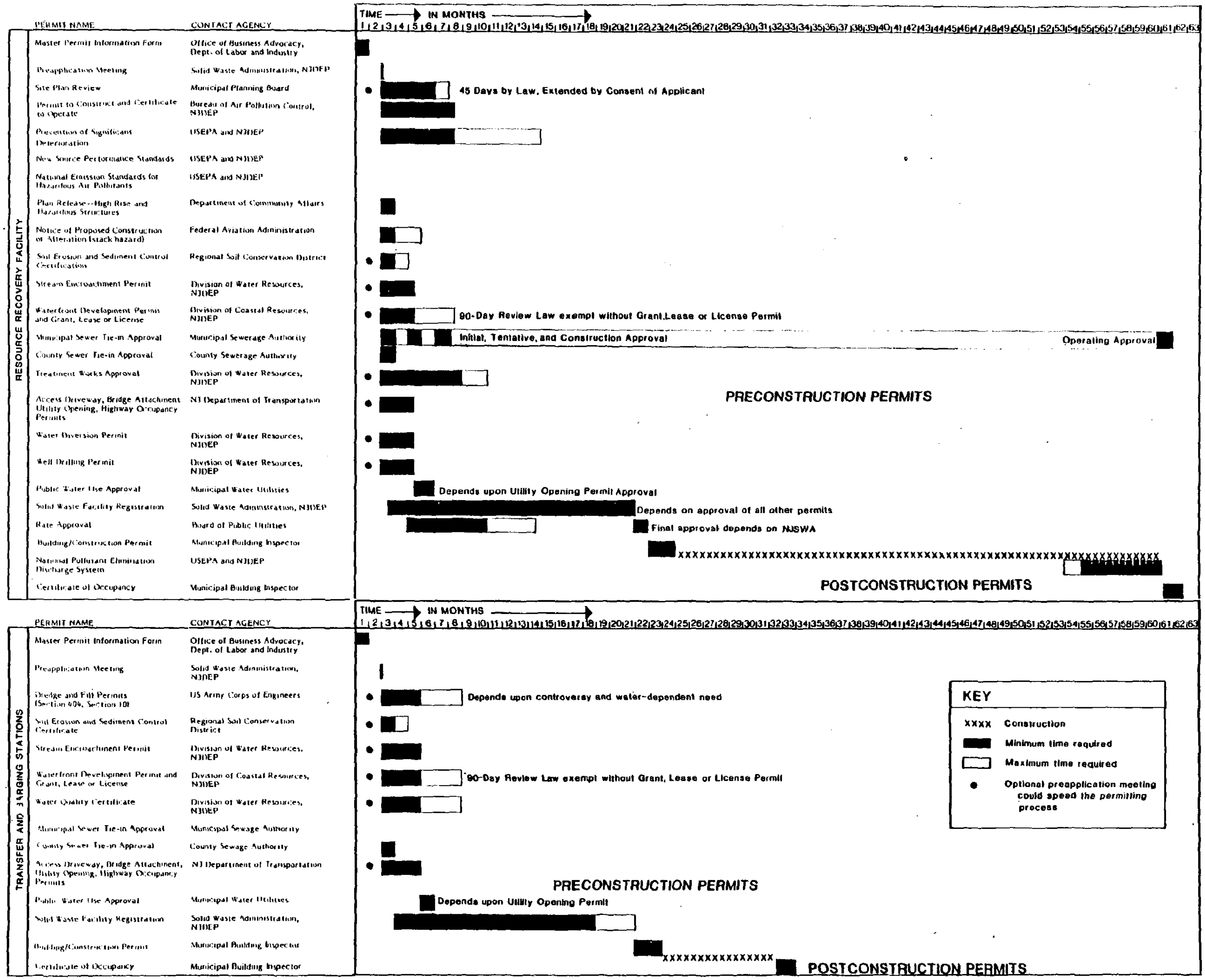
Figure B-1 describes graphically the permitting process in a time line configuration for a resource recovery facility and transfer and barging stations. Several permits must be applied for early in the process. Solid Waste Facility Registration approval depends on the approval of several other applications for permits. Several permits are applied for simultaneously in the third month. The permits are listed in order of relative importance, although denial of approval for any application may hold up construction.

BOARD OF PUBLIC UTILITIES RATE APPROVAL

In New Jersey, solid waste services and rates are regulated by the Board of Public Utilities (NJBPU). The builder must file an application with NJBPU to obtain a Certificate of Public Convenience and Necessity and an approved rate. Prior to construction NJBPU issues a Certificate of Public Convenience and Necessity and a proposed rate based on estimated construction and operation costs. Final rate approval is granted by NJBPU after construction but before operation when construction and operating costs are more exact.

The NJBPU, recognizing the large amount of time required to process permits with the NJDEP, has taken steps to review permits concurrently with the NJDEP. Once it is notified that the NJDEP applications are complete and in order, NJBPU will accept an application and begin the review process. Contingent on the NJDEP's approval of the applications, NJBPU, after its own economic review, will grant fee and rate approval.

Figure B-1. Permit process



S[redacted]: [redacted]rs, [redacted]en [redacted]

Because the NJBPU is interested in a proper rate determination, all information that is relevant to project costs is required: construction, operation, insurance coverage, financing, and environmental control costs. NJBPU's determination of a rate schedule would then be compared with the builder's proposed rate, and negotiations would follow. The process up to this point takes approximately 4 months (1 month for NJBPU review and 3 months of negotiations). Public hearings are also part of the application process. Depending on how controversial the project is, public hearings could take up to 6 months, although noncontroversial projects may require only a week for public hearings. Total time for the application process is approximately 5 to 10 months. As with most other permits, a complete application will speed the process.

For more information, contact:

Board of Public Utilities
1100 Raymond Boulevard
Newark, NJ 07102

AIR QUALITY PERMITS

Permit to Construct, Install, or Alter Control Apparatus or Equipment
Certificate to Operate or Control Apparatus or Equipment
Prevention of Significant Deterioration Permit
New Source Performance Standards
National Emission Standards for Hazardous Air Pollutants

Emissions from resource recovery facilities are regulated by state and federal authorities under the Federal Clean Air Act of 1977 (40 CFR 51.18) and the New Jersey State Air Pollution Control Act (NJSA 7:27 et seq.). Air quality criteria must be met by the facility in order to be in compliance with regulations. At this time, New Jersey standards are in a state of flux while discussions of state-of-the-art technology continue.

There are currently National and New Jersey Ambient Air Quality Standards for several pollutants (See table B-1). Specific design criteria have been formulated to help facilities meet the criteria for the emissions of hydrocarbons (photochemical oxidants, ozone). Incinerators should be designed for 1800°F and a minimum 1-second residence time to meet the .08 ppm standard. The state of New Jersey is reviewing these standards and may lower them to .03 ppm. Ozone production is a significant problem for New Jersey because the whole state is designated as a non-attainment area for ozone.

Current discussion in air pollution control revolves around the emission standards for hydrochloric acid, hydrofluoric acid, and other halogen acids (acid gases). The regulations require state-of-

Table B-1. National and New Jersey ambient air quality standards

Pollutant	Primary standards	Secondary standards
Sulfur dioxide		
Annual arithmetic mean	80 ug/m^3 (0.03 ppm)	.02 ppm (NJ standard only)
24-hr avg.	365 ug/m^3 (0.14 ppm)*	.10 ppm (NJ standard only)
3-hr avg.	--	1,300 ug/m^3 (0.50 ppm)*
Total suspended particulates		
Annual geometric mean	75 ug/m^3	60 ug/m^3**
24-hr avg.	260 ug/m^3*	150 ug/m^3*
Photochemical oxidants (ozone)		
1-hr avg.	160 ug/m^3 (0.08 ppm)*	160 ug/m^3 (0.08 ppm)*
Carbon monoxide		
8-hr avg.	10 mg/m^3 (9 ppm)*	10 mg/m^3 (9 ppm)*
1-hr avg.	40 mg/m^3 (35 ppm)*	40 mg/m^3 (35 ppm)*
Nitrogen dioxide		
Annual arithmetic mean	100 ug/m^3 (0.05 ppm)	100 ug/m^3 (0.05 ppm)
Lead		
Quarterly average	1.5 ug/m3	1.5 ug/m3

Source: NJDEP, Division of Environmental Quality, Bureau of Air Pollution Control, 1978; Reese, 1981.

Note: ppm = parts per million
ug/m^3 = micrograms per cubic meter
mg/m^3 = milligrams per cubic meter

* Not to be exceeded more than once per year
** Guideline for achieving the 24-hour secondary standard

the-art technology. The controversy stems from the development by a plant in Germany of an incinerator that can eliminate 99.9 percent of all hydrochloric acid in emissions. Because this costly procedure is the only known example of this level of control, NJDEP officials are debating whether it can be described as a state-of-the-art practice. A compromise may be reached at 50 ppm, or 90 percent control.

Air quality standards at a given site also must take into account ambient air quality standards. Ambient air quality standards represent a limit on the level of a pollutant in the air. It is the goal of air quality regulations to prevent or control pollutant emissions to the atmosphere. However, ambient air quality standards are not to be viewed as permissible limits for polluting the air.

Attainment areas are areas in which the ambient air concentrations for specific pollutants do not exceed air quality standards (conversely, non-attainment areas exceed standards). (See table B-2.) The entire state is in non-attainment for ozone, and therefore hydrocarbon emissions are strictly regulated. Particulates are in non-attainment in specific areas: Camden, Bridgeton, and northeast New Jersey. (See table B-3.) New facilities in or near these non-attainment areas must meet certain specifications for particulate emissions. Sixteen districts are confirmed non-attainment areas for carbon monoxide and 75 other areas are suspected non-attainment areas. NJDEP's Bureau of Air Pollution Control will be able to judge from emission estimates whether certain emission control specifications will be necessary.

New Jersey Air Quality Permits

New Jersey is among the states that have their own State Implementation Plans (SIPs) for air pollution control. Through the SIPs, each state determines how the Clean Air Act should be regulated within its borders. Although federal standards, methods, and implementation plans exist, the state can choose to adopt the same regulations (verbatim) from federal regulations, or, with federal approval, to adopt equally or more stringent standards for regulation. New Jersey is currently in the process of adopting more of the federal regulations (including Prevention of Significant Deterioration, New Source Performance Standards, and National Emissions Standards for Hazardous Air Pollutants). To avoid confusion as to who is currently responsible for regulation, applications should be made to both state and federal offices.

According to the Air Pollution Contol Act (NJSA 7:26:2C-9.2), plans to construct, install, or alter equipment capable of causing the emission of air contaminants, either directly or indirectly, require a permit and certificate to operate. Also covered in this section of the act are permits to install and operate

Table B-2. Air quality in New Jersey compared with air quality standards—1980

	Standard	Ambient air quality	
		New Brunswick	Perth Amboy
Sulfur dioxide 3-hr avg.	.5 ppm	.073 ppm (max.)	.258 ppm (max.)
Sulfur dioxide 24-hr avg. 1°	.14 ppm	.053 ppm (max.)	.172 ppm (max.)
Sulfur dioxide 24-hr avg. 2° (NJ standard)	.10 ppm		
Sulfur dioxide 12-mon avg. 1°	.03 ppm	.010 ppm (avg.)	.016 ppm (avg.)
Sulfur dioxide 12-mon avg. 2° (NJ standard)	.02 ppm		
Carbon monoxide 1-hr avg. 1°	35 ppm		14.5 ppm (avg.)
Carbon monoxide 1-hr avg. 2°	35 ppm		
Carbon monoxide 8-hr avg. 1°	9 ppm		9.8 ppm (avg.)
Carbon monoxide 8-hr avg. 2°	9 ppm		
Ozone maximum daily 1-hr avg. 1° (National standard)	.12 ppm	.188 ppm (max.)	
Ozone maximum daily 1-hr avg. 2° (National standard)	.12 ppm		
Ozone 1-hr avg. 1° (NJ standard)	.08 ppm	(No. of hrs above .08 = 210)	
Ozone 1-hr avg. 2° (NJ standard)	.08 ppm		
Nitrogen dioxide 12-mon avg. 1°	.05 ppm	.023 ppm (avg.)	
Nitrogen dioxide 12-mon avg. 2°	.05 ppm		
Nitric oxide (No standards established)		.026 ppm (avg.)	
Smoke shade (No standards established)			2.84 COHS* (2nd highest in state)

Source: NJDEP, Division of Environmental Quality, Bureau of Air Pollution Control, 1980a.

*COHS = Coefficient of haze units

Table B-3. Total suspended particulates

Location	Sampler no.	No. of samples	Annual geometric mean	24-hr avg. Maximum	24-hr avg. 2nd highest	No. above 260	No. above 150
Carteret-Sewage Plant	005	55	76.4	160	138	0	1
Carteret-Sewage Plant	SPM	29	*	116	98	0	0
Carteret-Sewage Plant	S61	54	61.1	230	144	0	1
Cheesequake St. Park	S09	61	44.6	109	103	0	0
Metuchen	S11	57	46.4	94	85	0	0
Middlesex	S35	55	53.3	111	109	0	0
Perth Amboy-Jefferson St.	023	58	72.7	146	134	0	0
Perth Amboy-Fayette St.	S68	14	*	68	65	0	0
Sayreville-Water Plant	028	7	*	73	72	0	0
Sayreville-Taft Place	S69	39	*	134	87	0	0
Sewaren	041	60	75.2	166	138	0	1
South Amboy	036	51	58.2	100	96	0	0
S. Brunswick Twp.	S01	61	43.2	101	84	0	0
Woodbridge Twp.	037	55	55.4	116	101	0	0

Source: NJDEP, Division of Environmental Quality, Bureau of Air Pollution Control, 1980a.

Note: Air quality standards for suspended particulates:
Annual geometric mean 1° stand.: 75 ug/m^3
Annual geometric mean 2° stand.: 60 ug/m^3

24-hr avg. 1°: 260 ug/m^3
24-hr avg. 2°: 150 ug/m^3

*Insufficient data for valid annual geometric mean.

a control apparatus, a device that prevents or controls the emission of air contaminants. Titled specifically "Permit to Construct, Install, or Alter Control Apparatus or Equipment" and "Certificate to Operate Control Apparatus or Equipment," this permit and certificate are handled within the NJDEP by the Bureau of Air Pollution Control. Applications and fees are to be submitted to the department, with details regarding the equipment or control apparatus, if necessary. Tests may be conducted prior to granting a Certificate to Operate to determine the kind and amount of air contaminants. Every five years the certificate must be renewed. A temporary 90-day operating certificate may be issued to allow for field evaluation and/or stack testing.

If it is determined during the application process that emissions will reach a certain level (50 tons per year, 1,000 pounds per day, or 100 pounds per hour), an air quality impact review must be made. The review determines, by use of an air quality simulation model, whether the emission would cause a threshold increase in ambient air concentrations in non-attainment areas (see table B-4).

If emissions are found to exceed threshold increases, emission offsets must be secured on or before the commencement of operation by adopting measures approved by the department to reduce the amount of actual emissions.

To begin the permit application process for air quality control, inquiries should be made to the Bureau of Air Pollution Control in the Division of Environmental Quality, NJDEP. The permitting process takes approximately six months, although, as is true of other permits, the completeness of the application and the controversy surrounding the project affect the processing time. Contact:

Bureau of Air Pollution Control
Division of Environmental Quality
Labor and Industry Building
Room 1110
Box CN-027
Trenton, NJ 08625

Federal Air Quality Permits

Federal regulations controlling air pollution come under the Clean Air Act as the Prevention of Significant Deterioration (PSD) permits. The goal of PSD permits is to ensure that air quality in clean air areas does not significantly deteriorate, while maintaining a margin for future industrial growth. USEPA lists steps to determine applicability:

- o definition of source (all emission units in the same industrial grouping on property under common ownership)

Table B-4. Threshold increases in ambient air concentrations for non-attainment areas

Pollutant	Annual	24-hr	8-hr	3-hr	1-hr
	Averaging time				
Sulfur dioxide	1.0 ug/m^3	5 ug/m^3	--	25 ug/m^3	--
Total suspended particulates	1.0 ug/m^3	5 ug/m^3	--	--	--
Nitrogen dioxide	1.0 ug/m^3	--	--	--	--
Carbon monoxide	--	--	0.5 mg/m^3	--	2 mg/m^3

Source: NJDEP, Division of Environmental Quality, Bureau or Air Pollution Control, 1980b.

- determination of potential to emit (an estimate of the emissions of criteria and noncriteria pollutants)

- determination of whether the source is a major stationary source or an unlisted stationary source (major stationary sources fall into one of 28 named source categories, emitting 100 tons per year of any pollutant regulated by the act. Also under PSD applicability are unlisted stationary sources emitting 250 tons per year of any pollutant.)

- determination of review requirements to be met.

The following analyses are performed for each pollutant emitted in significant quantities: a Best Available Control Technologies (BACT) review; an air quality anaysis; and additional impact analysis. Before a PSD permit can be granted, the applicant must demonstrate that neither National Ambient Air Quality Standards (NAAQS) nor allowable PSD increments will be violated as a result of the emissions from a new major source. (See table B-5.)

Application requires specific forms from USEPA and engineering plans for the proposed project. Processing takes a minimum of six months. The agency's goal for processing applications is one year. The length of the process depends on the quality of application (i.e., whether the information is complete and the test data are substantiated), the complexity of the project, and the vendor guarantees. If it is necessary to file with the federal government, this can be done concurrently with applications made to the state.

Both the federal and state air quality control permits should be approved before a construction permit is granted.

For more information, contact:

Permits Administration Branch
Planning and Management Division
USEPA Region II
26 Federal Plaza
New York, NY 10278

New Source Performance Standards (NSPS) (40 CFR 60.1 et seq.) set emission limits on particular pollutants of specific industrial categories. Incinerators handling more than 50 tons per day must come into compliance with NSPS regulations. Most resource recovery facilities fall under the category of incinerator. RRFs may also be regulated by NSPS under the category of fossil-fuel-fired steam generators. Certain criteria determine whether or not an RRF of this type must be regulated for emissions of particulates, sulfur dioxide, and nitrogen oxides. Prior to construction, application must be made to USEPA (or to the state, if

Table B-5. Regulated pollutants

Criteria pollutants	Noncriteria pollutants
Carbon monoxide	Asbestos
Nitrogen oxides	Beryllium
Sulfur dioxide	Mercury
Particulate matter	Vinyl chloride
Ozone	Fluorides
Lead	Sulfuric acid mist
	Hydrogen sulfide (H_2S)
	Total reduced sulfur (including H_2S)
	Reduced sulfur compounds (including H_2S)

Source: USEPA, 1980.

Director, Enforcement Division
USEPA Region II
Federal Office Building
26 Federal Plaza
New York, NY 10007

The National Emissions Standards for Hazardous Air Pollutants (NESHAP) (40 CFR 61.01 et seq.) regulate the emissions of highly toxic chemicals. NESHAP regulations cover asbestos, beryllium, mercury, vinyl chloride, benzene, arsenic, and radionuclides emissions. The owner or operator of a facility planning to emit any of these chemicals must submit to the USEPA an application for approval of construction or modification. Within two months of receipt of sufficient information to review an application, USEPA decides whether to deny or approve the application. If the application is denied, another two months are granted for the presentation of additional material. For information, contact:

Director, Enforcement Division
USEPA Region II
Federal Office Building
26 Federal Plaza
New York, NY 10007

WATER QUALITY PERMITS

Treatment Works Approval
NJ Pollutant Discharge Elimination System
National Pollutant Discharge Elimination System
Water Diversion Permit
Well Drilling Permit

In an effort to preserve the state's water quality, standards have be promulgated (NJAC 7:9-4 et seq.) to protect surface and groundwater quality. All waterways in New Jersey are classified according to current water quality and assigned designated uses and quality criteria: fresh water, tidal water, or coastal water. Streams are also classified as Trout production, Trout maintenance, and Nontrout streams. The most stringent quality criteria are applied to the Trout production streams and the least stringent to the Nontrout streams. Table B-6 lists the criteria for fresh, tidal, and coastal waters. Consultation with the Division of Water Resources will determine the classification of a particular stream, river, or other body of water.

The construction or operation of any new components of a sewer system (interceptors, collectors, force mains, etc.) that will treat domestic or industrial waste and discharge to surface waters requires a Treatment Works Approval from the Division of Water

Table B-6. Surface water quality criteria for tidal, fresh, and coastal waters (concentrations in micrograms per liter unless otherwise noted)

Substance	TW-1	TW-2	TW-3
Antidegradation policy	The antidegradation policy may supersede water quality criteria found in this section (7:9-4.7(d)).		
Floating, colloidal, color, settleable, and suspended solids (non-filterable residue); petroleum hydrocarbons and other oils and greases	1. None noticeable in the water or deposited along the shore, or on the aquatic substrata in quantities detrimental to the natural biota. None which would render the water unsuitable for the designated uses.		
	2. For "Petroleum Hydrocarbons" the goal is none detectable utilizing the Federal-Environmental Monitoring and Support Laboratory Method (Freon Extractable-Silica Gel Adsorption-Infrared Measurement); the present criteria, however, are those of paragraph 1 above.		
Turbidity (NTU)	Maximum 30-day average of 10 NTU, a maximum of 30 NTU at any time.		Maximum 30-day average of 15 NTU, a maximum of 50 NTU at any time.
Taste and odor producing substances	None offensive to humans or which would produce offensive taste or odors in biota used for human consumption. None which would render the waters unsuitable for the designated uses.		
pH (Standard Units)	6.5-8.5	6.5-8.5	6.5-8.5
Dissolved oxygen (mg/l)	24 hour average not less than 5.0. Not less than 4.0 at any time.	Not less than 4.0 at any time.	Not less than 3.0 at any time.
Temperature and heat dissipation areas	1. No heat shall be added which would cause temperatures to deviate from ambient stream temperatures by more than 2.2°C (4°F) during September through May, nor more than 0.8°C (1.5°F) during June through August, nor shall temperatures exceed 29.4°C (85°F).		
	2. Temperatures shall be measured outside of designated heat dissipation areas.		
	3. Heat dissipation area determinations: The determination of designated heat dissipation areas in tidal rivers, creeks, streams, and bay waters, shall take into consideration the extent and nature of such waters so as to meet the intent and purpose of the criteria and standards including provision for the passage of free-swimming and drifting organisms so that negligible or no effects are produced on their populations:		

Surface water quality criteria for tidal waters
(Concentrations are in micrograms per liter unless otherwise noted)

Substance	TW-1	TW-2	TW-3
	i. Tidal rivers, creeks, and streams - Heat dissipation areas shall be limited to no more than one-quarter (1/4) of the cross-sectional area and/or volume of flow of the body of water, leaving at least three-quarters (3/4) free as a zone of passage including a minimum of one-third (1/3) the surface measured from shore to shore at any stage of tide. These limitations may be exceeded by special permission, on a case-by-case basis, when the applicant can demonstrate that a larger heat dissipation area will provide for passage of free-swimming and drifting organisms and not become injurious to or impair designated uses. ii. Bay waters - Heat dissipation areas will be developed on a case-by-case basis and will provide for passage of free-swimming and drifting organisms and not become injurious to or impair designated uses. 4. Adjacent heat dissipation areas: Where waste discharges would result in heat dissipation areas in such close proximity to each other as to impair protected uses, additional limitations may be prescribed to avoid such impairment. 5. Temperature changes in designated heat dissipation areas shall not cause mortality of the aquatic biota nor create conditions which allow the introduction or maintenance of populations of undesirable organisms.		
Radioactivity	Prevailing regulations adopted by the U.S. Environmental Protection Agency pursuant to sections 1412, 1445, and 1450 of the Public Health Services Act, as amended by the Safe Drinking Water Act (PL 93-523).		
Bacterial quality (MPN/100 ml)	1. Approved shellfish harvesting waters: where shellfish harvesting is permitted, requirements established by the National Shellfish Sanitation Program as set forth in its current manual of operation shall apply. 2. All other waters: Fecal coliform levels shall not exceed a geometric average of 200/100 ml, nor should more than 10 per cent of the total samples taken during any 30-day period exceed 400/100 ml.	Fecal coliform levels shall not exceed a geometric average of 770/100 ml.	Fecal coliform levels shall not exceed a geometric average of 1500/100 ml.

Surface water quality criteria for tidal waters
(Concentrations are in micrograms per liter unless otherwise noted)

Substance	TW-1	TW-2	TW-3
	3. Samples shall be obtained at sufficient frequencies and at locations and during periods which will permit valid interpretation of laboratory analyses. Appropriate sanitary surveys shall also be carried out as a supplement to such sampling and laboratory analyses. As a guideline and for the purpose of these regulations, a minimum of five samples taken over a 30-day period should be collected, however, the number of samples, frequencies, and locations will be determined by the department in any particular case.		
Total dissolved solids - Filterable residue (mg/l)	None which would render the water unsuitable for the designated uses.		
Toxic or hazardous substances	1. None, either alone or in combination with other substances, in such concentrations as to affect humans or be detrimental to the natural aquatic biota, produce undesirable aquatic life, or which would render the waters unsuitable for the designated uses. 2. The concentration of a nonpersistent or noncumulative toxic or hazardous substance in the State's waters shall not exceed one-twentieth (0.05) of the 96 hour LC50 value, as determined by appropriate bioassays. 3. The concentration of a persistent or cumulative toxic or hazardous substance in the State's waters shall not exceed one one-hundredth (0.01) of the 96 hour LC50 value, as determined by appropriate bioassays. 4. QUALITY CRITERIA FOR WATER (United States Environmental Protection Agency, 1976), WATER QUALITY CRITERIA 1972 (National Academy of Sciences, National Academy of Engineering, March 1973, EPA-R3-73-033), other water quality criteria information published pursuant to Section 304(a) of the Clean Water Act of 1977, or other scientific information, shall be used for recommending toxicity levels of pollutants which may affect designated uses.		
Aldrin/dieldrin (Maximum concentration)	0.003	0.003	0.003
Benzidine (Maximum concentration)	0.1	0.1	0.1
DDT and metabolites (Maximum concentration)	0.001	0.001	0.001
Endrin (Maximum concentration)	0.004	0.004	0.004

Surface water quality criteria for tidal waters
(Concentrations are in micrograms per liter unless otherwise noted)

Substance	TW-1	TW-2	TW-3
Polychlorinated biphenyls (PCB) (Maximum concentration)	0.001	0.001	0.001
Total residual chlorine (TRC) (Maximum concentration)	10.0	10.0	10.0
Toxaphene (Maximum concentration)	0.005	0.005	0.005
Ammonia (Total as N) (Maximum concentration)	0.1 of 96 hr LC50	0.1 of 96 hr LC50	0.1 of 96 hr LC50

Surface Water Quality Criteria for Freshwater

(Concentrations are in micrograms per liter unless otherwise noted)

Substance	FW-Lower Mullica and Wading Rivers Central Pine Barrens	FW- Central Pine Barrens	FW-2-Trout Production	FW-2-Trout Maintenance	FW-2-Nontrout
Antidegradation policy	Except for FW-Lower Mullica and Wading Rivers - Central Pine Barrens and FW-Central Pine Barrens, the antidegradation policy may supersede the water quality criteria found in this section (7:9-4.6(e)).				
Floating, colloidal, color and settleable solids; petroleum hydrocarbons and other oils and grease	1. None noticeable in the water or deposited along the shore or on the aquatic substrata in quantities detrimental to the natural biota. None which render the waters unsuitable for the designated uses. 2. For "Petroleum Hydrocarbons" the goal is none detectable utilizing the federal EPA-Environmental Monitoring and Support Laboratory Method (Freon Extractable-Silica Gel Absorption-Infrared Measurement); the present criteria, however, are those of paragraph 1. above.				
Turbidity (Nephelometric Turbidity Unit-NTU)	Maximum of 20.0 NTU at any time.	Maximum of 20.0 NTU at any time.	Maximum 30-day average of 15 NTU, a maximum of 50 NTU at any time.		

Surface Water Quality Criteria for Freshwater

(Concentrations are in micrograms per liter unless otherwise noted)

Substance	FW-Lower Mullica and Wading Rivers Central Pine Barrens	FW- Central Pine Barrens	FW-2-Trout Production	FW-2-Trout Maintenance	FW-2-Nontrout
Suspended solids-non-filterable residue (mg/l)	Maximum of 40.0 at any time.	Maximum of 40.0 at any time.	Maximum of 25.0 at any time.		Maximum of 40.0 at any time.
Taste and odor producing substances	None offensive to humans or which would produce offensive taste or odors in water supplies and biota used for human consumption. None which would render the waters unsuitable for the designated uses.				
pH (Standard Units)	4.5-6.0	3.5-5.5	6.5-8.5	6.5-8.5	6.5-8.5
5 day Bio-chemical oxygen demand (mg/l)	Maximum of 5.0 at any time.	Maximum of 5.0 at any time.	None which would render the waters unsuitable for the designated uses.		
Dissolved oxygen	Not less than 85% saturation at any time.	Not less than 85% saturation at any time.	Not less than 7.0 mg/l at any time.	24 hour average not less than 6.0 mg/l. Not less than 5.0 mg/l at any time.	i. 24 hour average not less than 5.0 mg/l, but not less than 4.0 mg/l at anytime, except as noted in paragraph ii. below. ii. Not less than 4.0 mg/l at any time in the freshwater tidal portions of tributaries to the Delaware River, between Rancocas Creek and Big Timber Creek inclusive.

Surface Water Quality Criteria for Freshwater

(Concentrations are in micrograms per liter unless otherwise noted)

Substance	FW-Lower Mullica and Wading Rivers Central Pine Barrens	FW- Central Pine Barrens	FW-2-Trout Production	FW-2-Trout Maintenance	FW-2-Nontrout
Temperature and heat dissipation areas.	Not to deviate more than 2.8°C (5.0°F) from ambient stream temperature.	Not to deviate more than 2.8°C (5.0°F) from ambient stream temperature.	Ambient temperatures shall prevail except where properly treated wastewater effluents may be discharged. Where such discharges occur, stream temperatures shall not deviate more than 0.6°C (1.0°F) from ambient stream temperature.	1. Streams: i. No heat may be added which would cause temperatures to exceed 1.1°C (2°F) over ambient at any time or which would cause temperatures in excess of 20°C (68°F). Temperatures shall be measured outside of heat dissipation areas.	1. Streams: i. No thermal alterations which would cause temperatures to deviate more than 2.8°C (5.0°F) at any time from ambient temperatures. No heat may be added which would cause temperatures to exceed 27.8°C (82°F) for small mouth bass or yellow perch waters or 30°C (86°F) for other nontrout waters. Temperatures shall be measured outside of heat dissipation areas. 2. Lakes: i. No thermal alterations of more than 1.7°C (3°F) in the epilimnion of lakes and other standing waters. Temperatures shall be measured outside of heat dissipation areas. ii. Unless a special study shows that a discharge of a heated effluent into the hypolimnion or pumping water from the hypolimnion (for discharging back into the same water body) will be desirable with respect to designated water uses, such practices shall not be permitted.

Surface Water Quality Criteria for Freshwater

(Concentrations are in micrograms per liter unless otherwise noted)

Substance	FW-Lower Mullica and Wading Rivers Central Pine Barrens	FW- Central Pine Barrens	FW-2-Trout Production	FW-2-Trout Maintenance	FW-2-Nontrout
Temperature and heat dissipation areas				3. Heat dissipation determinations: i. The determination of heat dissipation areas shall take into special consideration the extent and nature of the receiving waters so as to meet the intent and purpose of the criteria and standards including provision for the passage of free-swimming and drifting organisms so that negligible or no effects are produced on their populations. ii. Streams: Heat dissipation areas shall be limited to no more than one-quarter (1/4) of the cross section and/or volume of flow of the body of water, leaving at least three-quarters (3/4) free as a zone of passage including a minimum of one-third(1/3) surface measured from shore to shore at any flow. These limitations may be exceeded by special permission, on a case-by-case basis, when the applicant can demonstrate that a larger heat dissipation area will provide for passage of free-swimming and drifting organisms and not become injurious to or impair designated uses. iii. Lakes, ponds, or reservoirs: Heat dissipation areas will be developed on a case-by-case basis and will provide for passage of free-swimming and drifting organisms and not become injurious to or impair designated uses. 4. Adjacent heat dissipation areas: Where waste discharges would result in heat dissipation areas in such close proximity to each other as to impair protected uses, additional limitations may be prescribed to avoid such impairment. 5. Temperature changes in designated heat dissipation areas shall not cause mortality of the aquatic life nor create conditions which allow the introduction or maintenance of populations of undesirable organisms.	

Surface Water Quality for Freshwater

(Concentrations are in micrograms per liter unless otherwise noted)

Substance	FW-Lower Mullica and Wading Rivers Central Pine Barrens	FW- Central Pine Barrens	FW-2-Trout Production	FW-2-Trout Maintenance	FW-2-Nontrout
Bacterial quality (MPN/100 ml)	1. Except as noted in paragraph two below, fecal coliform levels shall not exceed a geometric average of 200/100 ml., nor should more than 10 per cent of the total samples taken during any 30-day period exceed 400/100 ml. 2. Fecal coliform levels shall not exceed a geometric average of 770/100 ml. in the freshwater tidal portion of tributaries to the Delaware River, between Rancocas Creek and Big Timber Creek inclusive. 3. Samples shall be obtained at sufficient frequencies and at locations and during periods which will permit valid interpretation of laboratory analyses. Appropriate sanitary surveys shall be carried out as a supplement to such sampling and laboratory analyses. As a guideline and for the purpose of these regulations, a minimum of five samples taken over a 30-day period should be collected, however, the number of samples, frequencies and locations will be determined by the department in any particular case.				
Radioactivity	Prevailing regulations adopted by the U.S. Environmental Protection Agency pursuant to Sections 1412, 1445, and 1450 of the Public Health Services Act, as amended by the Safe Drinking Water Act (PL 93-523).				
Total dissolved solids - filterable residue (mg/l)	Maximum of 100 at anytime	Maximum of 100 at anytime	1. Not to exceed 500 mg/l or 133 per cent of background whichever is less. Notwithstanding this criterion, the department, after notice and opportunity for hearing, may authorize increases exceeding these limits provided the discharger responsible for such increases can demonstrate to the satisfaction of the department that such increases will not significantly affect the growth and propagation of indigenous aquatic biota or other designated uses, including public water supplies. 2. Any authorization by the department of such increases shall be conditioned upon utilization of the maximum practicable control technology.		
Chloride (mg/l)			Maximum of 250.0 at anytime.	Maximum of 250.0 at anytime.	Maximum of 250.0 at anytime.
Sulfate (mg/l)			Maximum of 250.0 at anytime.	Maximum of 250.0 at anytime.	Maximum of 250.0 at anytime.
Nitrate nitrogen (mg/l)	Maximum of 3.0 at anytime.	Maximum of 2.0 at anytime.	None which would render the waters unsuitable for the designated uses.		

Surface Water Quality Criteria for Freshwater

(Concentrations are in micrograms per liter unless otherwise noted)

Substance	FW-Lower Mullica and Wading Rivers Central Pine Barrens	FW-Central Pine Barrens	FW-2-Trout Production	FW-2-Trout Maintenance	FW-2-Nontrout
Phosphorus (mg/l)	Maximum of 0.7 at anytime - phosphorus as phosphate.		1. Lakes: Phosphorus as total P shall not exceed 0.05 in any reservoir, lake, pond, or in a tributary at the point where it enters such bodies of water, unless it can be demonstrated that total P is not a limiting factor considering the morphological, physical, chemical, and other characteristics of the water body. 2. Streams: Phosphorus as total P shall not exceed 0.1 in any stream, except at those locations in paragraph one above, where total P is determined to have a detrimental effect on stream use or to be the limiting factor considering the morphological, physical, chemical, and other characteristics of the water body.		
Toxic or hazardous substances	1. Allowing for natural conditions, none, either alone or in combination with other substances, in such concentrations as to affect humans or be detrimental to the natural aquatic biota, produce undesirable aquatic life, or which would render the waters unsuitable for the designated uses. None which would cause standards for drinking water to be exceeded after appropriate treatment. 2. The concentration of a nonpersistent or noncumulative toxic or hazardous substance in the State's waters shall not exceed one-twentieth (0.05) of the 96 hour LC50 value, as determined by appropriate bioassays. 3. The concentration of a persistent or cumulative toxic or hazardous substance in the State's waters shall not exceed one one-hundredth (0.01) of the 96 hour LC50 value, as determined by appropriate bioassays. 4. QUALITY CRITERIA FOR WATER (United States Environmental Protection Agency, 1976) WATER QUALITY CRITERIA 1972 (National Academy of Sciences, National Academy of Engineering, March 1973, EPA-R 3-73-033), other water quality criteria information published pursuant to Section 304(a) of the Clean Water Act of 1977, or other scientific information shall be used for recommending toxicity levels of pollutants which may affect designated uses.				
Ammonia (un-ionized; Maximum concentrations)	50.0	50.0	20.0	20.0	50.0

Surface Water Quality Criteria for Freshwater

(Concentrations are in micrograms per liter unless otherwise noted)

Substance	FW-Lower Mullica and Wading Rivers Central Pine Barrens	FW-Central Pine Barrens	FW-2-Trout Production	FW-2-Trout Maintenance	FW-2-Nontrout
Aldrin/dieldrin (Maximum concentrations)	0.003	0.003	0.003	0.003	0.003
Benzidine (Maximum concentrations)	0.1	0.1	0.1	0.1	0.1
DDT and metabolites (Maximum concentrations)	0.001	0.001	0.001	0.001	0.001
Endrin (Maximum concentrations)	0.004	0.004	0.004	0.004	0.004
Polychlorinated biphenyls (PCB) (Maximum concentrations)	0.001	0.001	0.001	0.001	0.001
Total residual chlorine (TRC) (Maximum concentrations)	3.0	3.0	3.0	3.0	3.0
Toxaphene (Maximum concentrations)	0.005	0.005	0.005	0.005	0.005

Surface water quality criteria for coastal waters
(Concentrations are in micrograms per liter unless otherwise noted)

Substance	CW-1	CW-2
Antidegradation policy	The antidegradation policy may supersede the water quality criteria found in this section (7:9-4.8(c))	
Floating, colloidal, color, suspended (filterable residue) and settleable solids petroleum hydrocarbons and other oils and greases	1. None noticeable in the water or deposited along the shore or on the aquatic substrata in quantities detrimental to the natural biota None which would render the waters unsuitable for the designated uses. 2. For "Petroleum Hydrocarbons" the goal is none detectable utilizing the Federal EPA Environmental Monitoring and Support Laboratory Method (Freon Extractable - Silica Gel Adsorption - Infrared Measurement); the present criteria, however, are those of paragraph 1. above.	
Turbidity (NTU)	Levels shall not exceed 10.0 NTU.	Levels shall not exceed 10.0 NTU.
Taste and odor producing substances	None offensive to humans or which would produce offensive taste or odors in biota used for human consumption. None which would render the waters unsuitable for human consumption.	
pH(Standard Units)	Natural pH conditions shall prevail.	Natural pH conditions shall prevail.
Dissolved oxygen(mg/l)	Not less than 5.0 at any time	Not less than 5.0 at any time.
Temperature and heat dissipation areas	No heat may be added directly to these waters. As a result of any heat which may be added elsewhere, the temperature shall not deviate from ambient temperatures by more than 2.2°C (4°F) during September through May, nor more than 0.8°C (1.5°F) during June through August, nor shall temperatures exceed 26.7°C (80°F).	1. No heat may be added which would cause temperatures to deviate from ambient temperatures by more than 2.2°C (4°F) during September through May, nor more than 0.8°C (1.5°F) during June through August, nor shall temperatures exceed 26.7°C (80°F). 2. Temperatures shall be measured outside of designated heat dissipation areas.

Surface water quality criteria for coastal waters
(Concentrations are in micrograms per liter unless otherwise noted)

Substance	CW-1	CW-2
		3. Heat dissipation area determinations: The determination of designated heat dissipation areas shall take into special consideration the extent and nature of such waters so as to meet the intent and purpose of the criteria and standards including provision for the passage of free-swimming and drifting organisms so that negligible or no effects are produced on their populations.
		4. Adjacent heat dissipation areas: Where waste discharges would result in heat dissipation areas in such close proximity to each other as to impair protected uses, additional limitations may be described to avoid such impairment.
		5. Temperature changes in designated heat dissipation areas shall not cause mortality of the aquatic biota nor create conditions which allow the introduction or maintenance of populations of undesirable organisms.
Radioactivity	Prevailing regulations adopted by the U.S. Environmental Protection Agency pursuant to Sections 1412, 1445, and 1450 of the Public Health Services Act, as amended by the Safe Drinking Water Act (PL 93-523).	
Bacterial quality (MPN/100 ml)	1. Approved shellfish harvesting waters: Where harvesting of shellfish is permitted, requirements established by the National Shellfish Sanitation Program as set forth in its current manual of operations shall apply.	
	2. All other waters: Fecal coliform levels shall not exceed a geometric average of 50/100 ml.	2. All other waters: Fecal coliform levels shall not exceed a geometric average of 200/100 ml nor should more than 10 per cent of the total samples taken during any 30-day period exceed 400/100 ml.

Surface water quality criteria for coastal waters
(Concentrations are in micrograms per liter unless otherwise noted)

Substance	CW-1	CW-2
	3. Samples shall be obtained at sufficient frequencies and at locations and during perids which will permit valid interpretation of laboratory analyses. Appropriate sanitary surveys shall also be carried out as a supplement to such sampling and laboratory analyses. As a guideline and for the purpose of these regulations, a minimum of five samples taken over a 30-day period should be collected, however, the number of samples, frequencies and locations will be determined by the department in any particular case.	
Toxic or hazardous substances	1. None, either alone or in combination with other substances, in such concentrations as to affect humans or be detrimental to the natural aquatic biota, produce undesirable aquatic life, or which would render the waters unsuitable for the designated uses. 2. The concentration of a nonpersistent or noncumulative toxic or hazardous substance in the State's waters shall not exceed one-twentieth (0.05) of the 96 hour LC50 value, as determined by appropriate bioassays. 3. The concentration of a persistent or cumulative toxic or hazardous substance in the State's waters shall not exceed one one-hundredth (0.01) of the 96 hour LC50 value, as determined by appropriate bioassays. 4. QUALITY CRITERIA FOR WATER (United States Environmental Protection Agency, 1976), WATER QUALITY CRITERIA 1972 (National Academy of Sciences, National Academy of Engineering, Mar EPA-R3-73-033), other water quality criteria informat pursuant to Section 304(a) of the Clean Water Act scientific information, shall be used for reco levels of pollutants which may affect desi	
Aldrin/dieldrin (Maximum concentration)	0.003	
Benzidene (Maximum concentration)	0.1	
DDT and metabolites (Maximum concentration)	0.001	

Surface water quality criteria for coastal waters
(Concentrations are in micrograms per liter unless otherwise noted)

Substance	CW-1	CW-2
Endrin (Maximum concentration)	0.004	0.004
Polychlorinated biphenyls (PCB) (Maximum concentration)	0.001	0.001
Total residual chlorine (TRC) (Maximum concentration)	10.0	10.0
Toxaphene (Maximum concentration)	0.005	0.005
Ammonia (Total as N) (Maximum concentration)	0.1of 96 hr LC50	0.1of 96 hr LC50

Source: NJDEP, Division of Water Resources, 1981.

The construction or operation of any new components of a sewer system (interceptors, collectors, force mains, etc.) that will treat domestic or industrial waste and discharge to surface waters requires a Treatment Works Approval from the Division of Water Resources, NJDEP. Regulations are contained in the New Jersey Water Pollution Control Act of 1977 (NJSA 58:10A-1 et seq.). Aspects of discharge covered by this permit include pretreatment and hookup to municipal facilities, discharge to surface water, and discharge to groundwater. These permits are generally classified as New Jersey Pollutant Discharge Elimination System (NJPDES) permits. Regulations concerning discharge and elimination were originally handled at the federal level, and the state of New Jersey is in the process of assuming full responsibility. Until New Jersey becomes fully responsible, however, certain permits must still be filed with USEPA in New York.

For discharge into a publicly owned treatment works (POTW), specific requirements for pretreatment must be met. The type of effluent discharge must be known before it can be determined whether the sewage treatment plant can handle the waste stream. If there are components of the waste stream (for example, certain priority pollutants) that cannot be handled by the POTW, then pretreatment at the facility is necessary before the waste load is sent out. The Federal Clean Water Act (Federal Water Pollution Control Act) Amendments spell out the pretreatment guidelines and standards. Most current pretreatment standards are found in 40 CFR 403.

Applications are made to the Division of Water Resources and include the NJDEP's standard form, map of municipal boundaries, plans of all sewers, engineers' reports, and appropriate municipal endorsements. From the information given in the application, the division can determine which permits are necessary and take appropriate review action. The entire permitting process for this kind of permit is very new and division policy has not yet been established. The Division staff suggests that at least six months are necessary for review. An important part of the procedure is the determination of a waste load allocation (the maximum waste load to point source discharges that can maintain water quality standards). To determine this allocation, more specific information is needed about the quantity and quality of the possible discharges. For applications, contact:

Permit Coordination Officer
Division of Water Resources
Department of Environmental Protection
1474 Prospect Street
Box CN-029
Trenton, NJ 08625

Because New Jersey has not entirely taken over the permitting process, applications must also be filed with USEPA for a National

Pollutant Discharge Elimination System (NPDES) permit for discharges into surface waters. USEPA has standard application forms and also requires specific information about the proposed discharge. There is a case-by-case investigation to determine criteria. Application to USEPA for NPDES must be made at least 180 days before the project is to begin discharging. For information about permits and application forms, contact:

Environmental Protection Agency
Region II
26 Federal Plaza
Room 908 — Attn.: Permits Branch
New York, NY 10007

In addition to discharge permits, water allocation permits are necessary for water pumped on site for operating purposes. In particular, permits to divert waters and drill wells are required of any person, corporation, or agency planning to divert more than 70 gallons per minute. The maximum withdrawal rate is specified by the state. Plans, specifications about the site and the water supply system, and the standard form for the Water Diversion Permit are all necessary for a complete application. The time it takes to process the application depends upon the complexity of the project but is estimated at three to six months. Contact begins with:

Bureau of Water Supply, Planning and Management
Division of Water Resources
NJDEP
Box CNO29
Trenton, NJ 08625

A permit is required for the drilling, boring, coring, or excavation of any well. The Well Drilling Permit also specifies that the construction of a well be under the supervision of a New Jersey licensed well driller. The permit is good for one year and must be renewed one year after date of issue. The application should be submitted with the standard CP-1 form, maps of well locations, and the well record (upon completion), and a well drilling sample may be required. Again, the process takes three to six months, depending upon the complexity of the project and the quality of the information. For more information, contact:

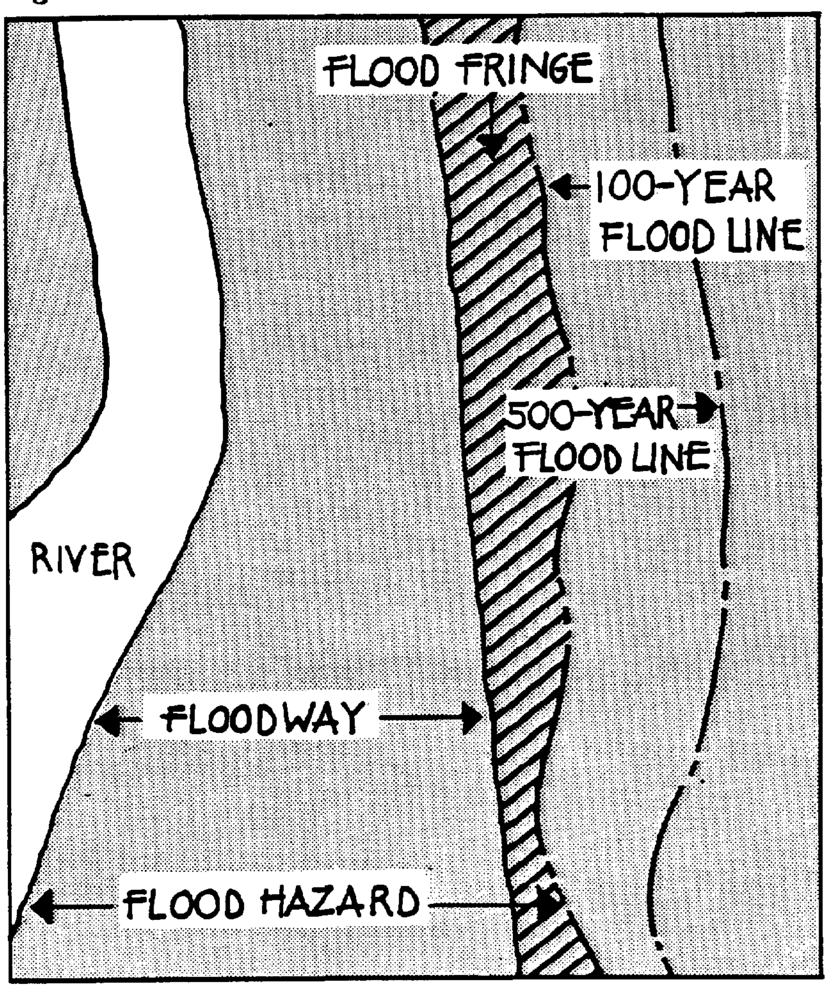
Bureau of Geology and Topography
Office of the Commissioner
NJDEP
P.O. Box 1390
Trenton, NJ 08625

FLOOD ZONE PERMITS

Stream Encroachment Permit
Waterfront Development Permit
Grant, Lease or License Permit

Construction in or near wetlands requires consideration of several of New Jersey's statutes protecting critical areas. To determine if a site is within a critical area, maps outlining flood zones and stream beds are readily available from the Bureau of Flood Plain Management, Division of Water Resources, NJDEP. If the Division of Water Resources is given an accurate description of the site location, it will send a map delineating the floodway and the flood hazard area.

Figure B-2. Flood zone



Source: Rogers, Golden & Halpern.

The flood zone is portrayed in figure B-2. Between the riverbed and the first solid line on land is the floodway; land beyond that, shaded and up to the double slashed line is the flood fringe. The double slashed line indicates the 100-year flood line, an averaging of the high-water peak in 100-year cycles. Building or construction within the 100-year flood line requires a stream encroachment permit. Building within the floodway is considered separate from building in the flood fringe. Beyond the 100-year flood line is a single slashed line denoting the 500-year flood line.

Under the Stream Encroachment Act (NJSA 58:1-26 et seq.), a permit is required for the construction, installation, or alteration of any structure or permanent fill along, in, or across the channel or floodway of any stream. The permit is also required for any alteration of the stream itself within the high-water mark of the 100-year flood, as determined by the state. The Flood Hazards Area Control Act (NJSA 58:16A-50) authorizes the state to control use and development on floodway and flood fringe areas.

Application for a Stream Encroachment Permit begins with contacting the stream encroachment section of the Division of Water Resources. The standard CP-1 form is required, along with an engineering data sheet, a location key map, drawings with property lines, photographs upstream and downstream of the project, a description of erosion and sediment control practices, and evidence that notification of application has been made to the required local agencies. For channel relocation and major fill projects, an Environmental Impact Statement is required.

The permit application is covered by the 90-Day Review Law (P.L. 1975 c. 232). (The law was enacted to ensure that NJDEP processes certain permits in 90 days or less.) After the application is determined to be complete, NJDEP has 90 days to make a decision on it. Contact begins at:

Bureau of Flood Plain Management
Division of Water Resources
NJDEP
1474 Prospect Street
P.O. Box CN-029
Trenton, NJ 08625

Also needed for some waterway construction is a Waterfront Development Permit (formerly called Riparian Lands Permit). This permit is necessary prior to the development of waterfront upon any tidal or navigable waterway. For example, the Raritan River is a navigable waterway, maintained by the US Army Corps of Engineers, upstream to New Brunswick. The waterfront area is defined in NJAC 7:7-2.4 as all tidal waterways and lands adjacent to them, up to the first property line or public road between 100 and 500 feet from the NJDEP waterway. Application to the NJDEP Division of Coastal Resources is required.

Information required for a complete application includes the standard CP-1 form, evidence of notification to municipal authorities, maps, plans, list of adjacent landowners, and evidence establishing the right to use or occupy riparian lands. If there is no grant, lease, or license for work below the high-water line, then an additional application must be made to the department for a Grant, Lease or License Permit. An inquiry to the Bureau of Tidelands Development in the Division of Coastal Resources will determine whether this second application is necessary. If only the Waterfront Development Permit is necessary, the processing takes 90 days after affirmation from the department of a complete application, since the permit is covered by the 90-Day Review Law. There is no time limit imposed if the Grant, Lease or License Permit is required, and the entire process could take six months. Contact:

Bureau of Coastal Projects Review
Division of Coastal Resources
NJDEP
Labor and Industry Building
Room 711
P.O. Box 1889
Trenton, NJ 08625

Note that the US Army Corps of Engineers must be notified of an application for a Waterfront Development Permit. Depending upon the location of the site, the Corps office in either New York or Philadelphia should be contacted. Dredge, fill, and disposal projects may require a Water Quality Certification from Division of Water Resources (see the section on US Army Corps of Engineers permits).

SOIL EROSION AND SEDIMENT CONTROL PLAN CERTIFICATION

Soil Erosion and Sediment Control Plans must be submitted to regional Soil Conservation District (SCD) offices or to municipal offices. Permits ensure that proper soil erosion and sediment control measures will be followed throughout the construction phase and that these measures will be in accordance with standards promulgated by the state. Regulations are outlined in the Soil Erosion and Sediment Control Act (NJSA 4:24-39 et seq.).

An application for certification should include four copies of the project or development plan on maps consistent with the Map Filing Act, with the location of the project referenced to a county map. Each copy should contain:

- contours at two-foot level showing ground elevation
- location of present and proposed drains and culverts, with their discharge capacity
- site grading plan

- delineation of any area subject to flooding from the 100-year storm in compliance with the Flood Hazards Area Control Act (NJSA 58:16A) or municipal zoning

- delineation of streams within the project area

- location of all proposed soil erosion and sediment control facilities

- land cover and use of adjacent area

Also needed for complete application are four copies of a narrative Soil Erosion and Sediment Control Plan indicating:

- proposed sequence of development

- identification of land areas that will not be disturbed

- planned soil erosion and sediment control measures and facilities, with supporting computation based on NJ Soil Conservation Committee standards

- plans for maintenance of soil erosion and sediment control measures and facilities during construction.

A fee schedule, determined by the scope of the project, is included on the application. Payment of fee should accompany the application.

When filing for a Soil Erosion and Sediment Control Plan Certification, contact begins with regional SCD offices. When a municipality has its own erosion control ordinance, further contact with the municipal office is required for application.

The usual amount of time required for processing an application is 30 days. As with other permits, the processing time is dependent upon the completeness and thoroughness of the application and the scope of the project. The application must be filed and approved before any land disturbance (construction) can begin. A cautious municipality would not approve a construction/building permit prior to assurance of SCD permit approval.

The agencies to contact are listed below by county. To determine whether the municipality under consideration for a facility is exempt from regional SCD jurisdiction, contact the county office.

Bergen SCD
389 Main Street
Hackensack, NJ 07601

Burlington SCD
Cramer Building
Route 38
Mt. Holly, NJ 08060

Camden SCD
Municipal Building
59 South White Horse Pike
Berlin, NJ 08009

Cape-Atlantic SCD
Atlantic County Office Building
1200 West Harding Highway
Mays Landing, NJ 08330

Cumberland SCD
Route 77
Box 148
Seabrook, NJ 08302

Freehold SCD (Monmouth and Middlesex counties)
20 Court Street
Freehold, NJ 07728

Gloucester SCD
North Black Horse Pike
Box L
Williamstown, NJ 08094

Hudson Essex and Passaic SCD
201 Bloomfield Avenue
Verona, NJ 07044
201-239-1886

Hunterdon SCD
Route 6
Box 49
Flemington, NJ 08822

Mercer SCD
930 Spruce Street
Trenton, NJ 08648

Morris SCD
Court House
Morristown, NJ 07960

Ocean SCD
Ocean County Agriculture Center
Whitesville Road
Toms River, NJ 08753

Salem SCD
1000 East Route 40
Box 47
Woodstown, NJ 08098

Somerset-Union SCD
Somerset County 4-H Center
308 Milltown Road
Bridgewater, NJ 08807

Sussex SCD
Box 13 RD #1
Newton, NJ 07860
201-852-2579

Warren SCD
Stiger Street
Hackettstown, NJ 07840

State Soil Conservation Committee
Division of Rural Resources
Department of Agriculture
Health-Agriculture Building
Box 1888
Trenton, NJ 08625

Some townships have their own soil erosion and sedimentation control ordinances. Permits for these townships must be filed through the municipal office rather than the regional SCD.

PLAN RELEASE—HIGH RISE AND HAZARDOUS STRUCTURES

Before a construction permit is issued by a municipal agency, specific information about the project must be provided so that it can receive a Plan Release. The Uniform Construction Code has divided construction into three classes according to complexity and hazard to public health and safety. Municipal Construction Code Enforcement Officials are similarly classified in three levels. Class I municipal officials are licensed to review all types of new construction; Class II officials review simpler industrial and commercial construction and residential construction; and Class III officials review residential construction only. Plans for an RRF in a municipality with Class I officers need not be submitted to the state; the municipality can approve the plan release. The review process takes approximately 30 days, and application should be made before a construction permit is needed.

For general information, contact:

Plan Review and Inspection Office
Division of Housing and Urban Renewal
Department of Community Affairs
363 West State St.
P.O. Box 2768
Trenton, NJ 08625

NOTICE OF PROPOSED CONSTRUCTION OR ALTERATION

Notification of the Federal Aviation Administration (FAA) is required before the construction or alteration of an object that may interfere with navigable airspace, according to Federal Aviation Regulations, Part 77, Subchapter B. Filing is necessary if one or more of the following conditions is present:

- any structure of more than 200 feet above the ground level at its site
- construction near airport runways (see application for specific information)
- construction near seaplane or heliport base
- construction of highway, railroad, or transportation route, that, with traffic height adjustments, exceeds a certain standard

The FAA must be notified at least 30 days before a construction permit is to be filed. Standard forms are included in the application and require a description of the structure, the location of the site, relationship to the nearest airport, etc. The completed FAA form and the Notice of Proposed Construction or Alteration should be forwarded to the Chief, Air Traffic Division. The FAA reviews the project plans and makes recommendations about the facility (e.g., lighting and painted markings on a stack). The reviewed process takes 30 days. If, however, the recommendations of the FAA cannot be carried out or are disputed by the builder, the case is brought before the aviation public and reviewed after public hearings. It may be three months before a final determination is made.

For information, contact:

Chief, Air Traffic Division
JFK International Airport
Federal Building
Jamaica, NY 11430

NJ DEPARTMENT OF TRANSPORTATION PERMITS

Access Driveway Permit
Bridge Attachment Permit
Highway Occupancy Permit
Utility Opening Permit

For any type of work performed within the state highway system, a Highway Permit or Agreement is required by the New Jersey Department of Transportation under Section 27:7-44.1 of the state highway laws.

Among the permits that may be required for the building of a resource recovery facility are:

o Access Driveway Permit - required before construction of one or more driveways on a state highway in New Jersey, or before any reconstruction, or modification of an existing driveway

o Bridge Attachment Permit - required before construction of an attachment to a bridge on or over a state highway

o Highway Occupancy Permit - required for any of the following uses of the state right-of-way: street intersection construction, curb construction, sidewalk construction, overdimensioned and overweight movement, temporary use of right-of-way, telephone booth installment, crossover or U-turn slots in median, etc.

o Utility Opening Permit - required of the utility company before opening a state highway roadway for the purpose of installing, repairing, or relocating a utility line.

Applications for highway permits may be obtained from the Construction and Maintenance Unit Regional Offices or from the department's Central Permit Office. Completed applications are to be forwarded to the regional office having jurisdiction over the area in which work is to be performed.

Central Office:

New Jersey Department of Transportation
Bureau of Maintenance and Construction
1035 Parkway Avenue
Trenton, NJ 08625

Regional Offices:

Region I—Netcong Office: Hunterdon, Morris, Somerset, Sussex, and Warren counties
NJDOT
Route 206
Box 55
Netcong, NJ 07857

Region II—Newark Office: Bergen, Essex, Hudson, Passaic, and Union counties
NJDOT
Routes 1, 21 and 22
Newark Junction
Newark, NJ 07114

Region III—Freehold Office: Burlington, Mercer, Middlesex, Monmouth, and Ocean counties
NJDOT
Route 9
Box 272B, R.D. #4
Howell, NJ 07731

Region IV—Cherry Hill Office: Atlantic, Cape May, Gloucester, Camden, Cumberland, and Salem counties
NJDOT
Route 70 at NJ Turnpike
Cherry Hill, NJ 08034

An application for a highway permit must include six copies of a legible plot plan (topographical plan) illustrating the proposed installation or project and containing the following information if applicable:

- Type of construction
- Site location
- Right-of-way line
- Property line
- Offset
- Setback and location of structure
- Elevation and topography
- Curbing
- Parking facilities
- Location of driveways
- Existing and proposed conditions
- Sidewalk
- Drainage
- Highway electrical installations
- Trees within state right-of-way
- Poles
- Advisory, directional, and regulatory signs

It is important to note that construction work under the terms of the highway permit must be completed within one year of the date of issuance, or the permit expires and becomes null. At the discretion of the department, a highway permit may be renewed under the same terms and conditions, provided that a request is made to the department before the permit expires.

The proper application form for the project and the type of work neccessary must be obtained, completed, and submitted, along with the copies of the plot plan and other pertinent information. The following forms are required for specific permits:

Form MT-32 - Application for Access Driveway

Form MT-105A - Application for Bridge Attachment

Form MT-17A - Application for Utility Opening

Form MT-120A - Application for Highway Occupancy

Applications must be accompanied by fee payment. Fee schedules are listed on the application.

The time taken to process an application depends on the size of the plant, traffic patterns, and the number of commuting employees. Naturally, the greater the traffic movement, the more time is necessary for processing. The simplest design will take 30 days to process. To speed the process along, NJDOT suggests that plans be submitted for a preliminary site plan review by the design section of NJDOT in Trenton. This is not a formal application and the decisions of NJDOT are not binding. But the preliminary review helps to identify problem areas, and if suggestions made by the design group are carried out, the permitting process can move along more rapidly.

Again, all NJDOT applications should be filed and approved before a construction permit is granted.

SOLID WASTE FACILITY REGISTRATION

Transfer Station

Although transfer stations may be part of the same project as resource recovery facilities, separate Solid Waste Facility Registration applications must be filed for them at the NJ Solid Waste Administration. Specific engineering plan requirements are outlined for transfer stations. Although the applications may be made concurrently, it is important to note that they are two separate applications.

US ARMY CORPS OF ENGINEERS PERMITS

Discharge of Dredged Materials Permit (Section 404)
Building on a Waterway Permit (Section 10)
Water Quality Certificate

Applications for all permits are made on one general form. The US Army Corps of Engineers then decides which permits are necessary and which permits will be approved. The application is made at the district level in either New York or Philadelphia, depending on facility location, and subsequently the content of the application is made a matter of public record through the issuance of a public notice.

Under Section 404 of the Federal Water Pollution Control Ammendments and Section 10 of the River and Harbor Act, permits are required for structures and work affecting navigable waters of the United States, the discharge of dredged or fill materials into navigable waters, and the transportation of dredged material for the purpose of dumping it into ocean waters. The following information is necessary for these permit applications:

- description of proposed activity, purpose, use, type of structures, vessels, facility to handle waste, and the type, composition, and quality of dredged or fill material

- names and addresses of adjoining property owners and those on the opposite stream bank

- complete information about the location (street number, tax assessor's description, name of waterway) in enough detail that the site can be easily located during a field visit

- list of all approvals and certifications required by other federal, state, and local agencies, and their status

- explanation of any denials of approval or certification by other government agencies

The goal of the Corps of Engineers is to have permits reviewed, given public notice, and thoroughly processed in 90 days. If the project is controversial, the processing time could take much longer. Naturally, if the application is complete, with all the necessary information included, and maps clearly marked, the processing time could be shortened.

Filing with the Corps does not eliminate the need to file for necessary state permits. For example, building transfer stations along a waterway also requires applications to NJDEP for Waterfront Development (Riparian Lands), Stream Encroachment, and Wetlands Permits, as well as those associated with any further construction activity.

For any kind of dredging project a Water Quality Certificate is required by the state. The information necessary is listed in detail on the CP-1 form of the state. The information should include evidence of adequate public notification, a site location map, drawings (engineering plans) that include adjacent property, methods of dredging to be used, the quantity of dredged spoil and the site of disposal, and color photos. Note also that upland disposal of dredged spoil must be approved by the Solid Waste Administration. Chemical analysis of dredged spoil may be necessary. For information, contact:

Division of Water Resources
1474 Prospect Street
P.O. Box CN029
Trenton, NJ 08625

For Section 404 or Section 10 Permits in areas north of the Manasquan River, contact:

Operational Division of the Army Corps
Channel Dredging
Army Corps of Engineers
NY District
26 Federal Plaza
New York, NY 10007

For areas south of the Manasquan River, contact:

Army Corps of Engineers
Philadelphia District
Customs House
Second and Chestnut Streets
Room 404
Attn: Permits Branch
Philadelphia, PA 19106

LOCAL PERMITS

Site Plan Review
Public Water Use Approval
Sewer Plans and Tie-In Approval
Building Permit
Certificate of Occupancy

Several permits are required at the local level. Among the permits that may be required are:

- Site Plan Approval
- Public Water Use Approval
- Sewer Plans and Tie-In Approval
- Building Permit

o Certificate of Occupancy

Obtaining Site Plan Approval early in the permitting process ensures a good working relationship between the municipality and the builders of the facility. In New Jersey, depending upon the municipality, Site Plan Approval may involve working not only with the planning board but also with the environmental commissions. Approval by the municipality can take between 45 and 90 days, depending upon how controversial the plan is.

Contact with local sewerage authorities should also be made early in the permit application process. Involvement with the sewerage authority continues over a long period of time, beginning with the initial application. With type, quantity, and estimated flow figures from the applicant, the sewerage authority can determine whether or not it is in a position to accept the waste. If it is, the application procedure continues through the construction phase to include Classification Approval, Tentative Approval, and Construction Approval of the sewer hookup. Finally, after construction, the authority must give operating approval.

Obtaining Public Water Use Approval is a somewhat simpler process. Information on the number of water taps and their size should be brought to the municipal building. The whole process could take just a few hours. However, before obtaining water use approval, an application must be made to the Department of Transportation for a Road Opening Permit. (Usually water lines run near roadbeds, and some construction in or near roadways is inevitable.) Public Water Use Approval will not be granted unless a Road Opening Permit has been obtained.

One of the very last applications to be made by the builders is for the Building Permit. Municipalities should carefully determine what permits are required to build the facility and be sure that all necessary applications have been approved (not simply filed with the proper agency). This safeguard can assure the municipality that construction will correctly meet regulated procedures. Obtaining a Building Permit can take 30 to 60 days, depending upon the complexity of the project and the municipality's familiarity with the plans for it.

In the last stages of construction, an application should be filed with the municipal building inspector for a Certificate of Occupancy.

The number of permits required at the local level depends on municipal ordinances. For example, some municipalities have their own soil erosion and sediment control ordinances. In this case, applications are made to the municipality rather than to the regional Soil Conservation District. Local ordinances regulating noise are also becoming more common throughout the state. A close working relationship between municipal officials and the facility's builders can eliminate oversights of local ordinances.

GENERAL STATE PERMITS—CRITICAL LANDS

Projects planned for any of four sensitive, critical areas in the state require contact with the council or commission overseeing land use in these areas. These critical areas and the governing bodies are listed below.

Coastal Area Facility Review Act

To encourage a comprehensive consideration of coastal ecology, the federal government developed the Coastal Zone Management Act (CZMA). Under this act, each state designates a lead agency to be primarily responsible for implementing the federal program. In New Jersey, the Division of Coastal Resources of NJDEP has developed the Coastal Area Facility Review Act (CAFRA) to regulate and approve the location, design, and construction of major facilities in the state's coastal regions. A permit is required before construction can begin. An EIS and public hearings are part of the application process. For information, contact:

Bureau of Coastal Enforcement and Field Services
Department of Environmental Protection
1433 Hooper Avenue
Toms River, NJ 08753

Delaware and Raritan Canal Commission

For projects that fall within its jurisdiction and could prove to have an impact on the Delaware and Raritan Canal Park, the Delaware and Raritan Canal Commission reviews development plans. Plans are reviewed in reference to economic, social, and environmental impacts on the park. Jurisdiction over lands includes all or portions of these municipalities:

Hunterdon County
- Delaware Township
- East Amwell Township
- Franklin Township
- Kingwood Township
- Lambertville City
- Raritan Township
- Stockton Borough
- West Amwell Township

Mercer County
- East Windsor Township
- Ewing Township

Middlesex County
- Cranbury Township
- Monroe Township
- New Brunswick City
- North Brunswick Township
- Plainsboro Township
- South Brunswick Township

Monmouth County
- Manalapan Township
- Millstone Township
- Roosevelt Borough
- Upper Freehold Township

Hamilton Township
Hightstown Borough
Hopewell Borough
Hopewell Township
Lawrence Township
Pennington Borough
Princeton Borough
Princeton Township
Trenton City
Washington Township
West Windsor Township

Somerset County
- Franklin Township
- Hillsborough Township
- Manville Borough
- Millstone Borough
- Montgomery Township
- Rocky Hill Borough
- South Bend Brook Borough

For more information, contact:

Delaware and Raritan Canal Commission
25 Calhoun Street
Box 1390
Trenton, NJ 08625

Hackensack Meadowlands Development Commission

The Hackensack Meadowlands Development Commission is responsible for regulating development within the Meadowlands District. The commission is empowered to review applications for development within the district and issues a number of certificates, approvals, and permits, inclding: Zoning Certificates, Site Plan Approval, Variance, Subdivision, Building, and Fill Permits. Jurisdictional areas include all or part of the following municipalities:

Bergen County
- Carlstadt Borough
- East Rutherford Borough
- Little Ferry Borough
- Lyndhurst Township
- Moonachie Borough
- North Arlington Borough
- Ridgefield Borough
- Rutherford Borough
- South Hackensack Township
- Teterboro Borough

Hudson County
- Jersey City
- Kearny Town
- North Bergen Township
- Secaucus Town

For more information, contact:

Hackensack Meadowlands Development Commission
100 Meadowland Parkway
Secaucus, NJ 07094

Pinelands Environmental Council

Planning for the development of land and other resources within the Pinelands of Ocean and Burlington counties requires contact with the Pinelands Environmental Council. The council functions as an advisory body with the power of review over projects that may impact the Pinelands. The applicant should contact the council to determine whether the proposed project is situated within the jurisdictional areas. Contact:

Pinelands Environmental Council
State Highway #70
RD #2
Box 2857
Brown Mills, NJ 08015

NOISE CONTROL

At this time, no noise permits are required by the state. However, certain noise levels must be maintained during operation. The Noise Control Regulations (NJAC 7:29-1.2) require that between 7:00 a.m. and 10:00 p.m., "No person shall cause, suffer, allow...from any industrial...operation...

a. a continuous airborne sound at a level in excess of 65 dBA

b. a continuous airborne sound with an octave band sound pressure level that exceeds certain values in one or more octave bands (table B-7):

Table B-7. Prohibited octave band sound pressure levels

Octave band center frequency (Hz)	Octave band sound pressure level (dB)
31.5	96
63	82
125	74
250	67
500	63
1000	60
2000	57
4000	55
8000	53

Source: NJDEP, Office of Noise Control, 1974.

c. an impulsive sound in the air with an impulsive sound level in excess of 80 decibels."

To eliminate problems of nonconformance to regulations, the Office of Noise Control suggests a preliminary consultation with the state to examine plans and determine the best placement for heavy machinery, traffic flow, activity in proximity to residences, and buffer zones. Also available from the state office are lists of acoustical consultants and companies that manufacture acoustical material. As well as the state issuing regulations, local municipalities may pass ordinances requiring noise quality control.

Due to the small size of the Office of Noise Control staff, there are no monitoring stations in New Jersey and no data on ambient noise quality. Complaints about excessive noise can be registered with the Office of Noise Control, and testing can be done on site. For information, contact:

Office of Noise Control
Division of Environmental Quality
NJDEP
P.O. Box CN027
Trenton, NJ 08625

FOGGING AND CONDENSATION ON ROADS AND HIGHWAY

Inquiries of NJDOT, USEPA's Division of Air Pollution Control, and the US Department of Energy indicate that there are currently no regulations concerning vapor condensation on roadways. This problem has not arisen yet, and no agency has been designated to take care of the problem should it arise.

HISTORICAL AND ARCHAEOLOGICAL SITING

Prior to construction, a review of the site must be made to determine whether it has any historical or archaeological significance. The Office of Cultural and Environmental Services, with the proper information, can help in this determination. The information required includes a USGS map reference, a photocopy of the map with the project site marked, and a brief description of the project and any federal funding involved. For information, contact:

Office of Cultural and Environmental Services
NJDEP
P.O. Box 1390
Trenton, NJ 08625

The municipality should also be contacted for information about previously conducted surveys of historical sites.

SOURCES

Information Sources

The following agencies were contacted for information used in preparing this appendix. The New Jersey State Government switchboard telephone number is (609)292-2121.

State Agency	Information
Permit Coordination Office of Business Advocacy Dept. of Labor and Industry P.O. Box 2766 Trenton, NJ 08625	Master Permit Information Form
State Soil Conservation Committee Dept. of Agriculture Health-Agriculture Building P.O. Box 1888 Trenton, NJ 08625 or regional Soil Conservation District offices	Soil Erosion and Sediment Control Plan Certification
Permit Coordination Officer	
Division of Water Resources Dept. of Environmental Protection 1474 Prospect Street P.O. Box CN-029 Trenton, NJ 08625	Water Diversion Permit Water Quality Certification Stream Encroachment Permit Treatment Works Approval NJPDES
Water Allocation Division of Water Resources Dept. of Environmental Protection P.O. Box CN-029 Trenton, NJ 08625	Well Drilling Permits
Bureau of Flood Management Division of Water Resources Dept. of Environmental Protection 1474 Prospect Street P.O. Box CN-029 Trenton, NJ 08625	Flood Plain Mapping Information

Bureau of Coastal Enforcement and Field Services Dept. of Environmental Protection Toms River, NJ 08753	Preliminary Inquires for Coastal Resources Permits
Bureau of Coastal Projects Review Dept. of Environmental Protection Labor and Industry Building Room 711 P.O. Box 1889 Trenton, NJ 08625	Waterfront Development Permit and Wetland Permits
Bureau of Technical Sevices Solid Waste Administration Division of Environmental Quality 32 East Hanover Street P.O. Box CN-027 Trenton, NJ 08625	Solid Waste Facility Registration
Bureau of Air Pollution Control Division of Environmental Quality Room 1110 Labor and Industry Building P.O. Box CN-027 Trenton, NJ 08625	Permit to Construct, Install, or Alter and Certificate to Operate Control Apparatus or Equipment Emission Offset Rules
Department of Community Affairs 363 West State Street Trenton, NJ 08625	Plan Release
State Bureau of Geology P.O. Box 2809 Trenton, NJ 08625	Maps
Office of Cultural and Environmental Services Dept. of Environmental Protection P.O. Box 1390 Trenton, NJ 08625	Historical and Archaeological Site Review
NJ Dept. of Transportation Div. of Environmental Analysis 1035 Parkway Avenue Trenton, NJ 08618	Access Driveway Permit Highway Occupancy Permit Bridge Attachment Permit Utility Opening Permit
Board of Public Utilities 1100 Raymond Boulevard Newark, NJ 07102	Rate Approval

Federal Agency	Information
USEPA Region II 26 Federal Plaza New York, NY 10007 Div. of Water Quality Div. of Air Pollution Control	PSD Permits NPDES Permits
Chief, Air Traffic Division JFK International Airport Federal Building Jamaica, New York 11430 212-995-3390	Notice of Proposed Construction or Alteration (aviation hazard)
District Engineer Permit Control Branch Army Corps of Engineers 26 Federal Plaza New York, NY 10007	Section 404, Section 10 Permits: Discharge of Dredged Materials Permit Building on a Waterway Permit (North Jersey)
District Engineer Permit Control Branch Army Corps of Engineers U.S. Customs House 2nd and Chestnut Street Philadelphia, PA 19106	Section 404, Section 10 Permits: Discharge of Dredged Materials Permit Building on a Waterway Permit (South Jersey)

Environmental Groups Information	
American Littoral Society Sandy Hook Highlands, NJ 07732	Coastal Wetlands Information
Association of New Jersey Environmental Commission Box 157 Mendham, NJ 07945	Local and Statewide Information
Interstate Sanitation Commission 10 Columbus Circle Room 1620 New York, NY 10019	General Information

Sources Cited

American Littoral Society. 1981. Protecting wetlands: what you should know.

Department of the Army, Office of the Chief of Engineers. 1977. U.S. Army Corps of Engineers permit program: a guide for applicants. EP 1145-2-1, November 1977.

Freehold Soil Conservation District. n.d. Erosion and sediment control notes.

General Services Administration. 1977. Federal guidelines, state and local pretreatment programs.

Institute for Environmental Education and Association of New Jersey Environmental Commissions. 1978. Tuning the green machine.

NJDEP. 1974. NJAC 7:26-1 et seq. Rules of the Bureau of Solid Waste Management, effective July 1, 1974.

NJDEP, Division of Coastal Resources. 1980. New Jersey Coastal Management program: summary and management system.

NJDEP, Division of Environmental Quality, Bureau of Air Pollution Control. 1978. Proposed New Jersey State Implementation Plan for the attainment and maintenance of air quality standards, December 1978.

NJDEP, Division of Environmental Quality, Bureau of Air Pollution Control. 1980a. Air quality in New Jersey compared with air quality standards.

NJDEP, Division of Environmental Quality, Bureau of Air Pollution Control. 1980b. NJAC 7:27-18, Control and prohibition of air pollution from new or altered sources affecting ambient air quality in non-attainment areas (Emission Offset Rule), effective 8 September 1980.

NJDEP, Division of Water Resources. 1981. NJAC 7:9-4.1 et seq. Amended rules concerning water quality standards, March 1981.

NJDEP, Division of Water Resources. 1981. NJAC 7:14A-1 et seq. Regulations concerning the New Jersey Pollutant Discharge Elimination System, March 1981.

NJDEP, Office of Noise Control. 1974. NJAC 7:29-1.2. Noise control regulations, effective 23 January 1974.

NJDEP, Solid Waste Adminstration. 1978. Supplement to the rules of the Solid Waste Adminstration.

NJDEP Solid Waste Administration. n.d. Engineering plan requirements for transfer station.

NJDEP, Solid Waste Administration. n.d. Notice to potential applicants for new or expanded solid waste facilities.

NJDEP, Solid Waste Administration. n.d. Planning and resource management guidelines for the preparation of an application for resource recovery facilities.

NJ Department of Transportation, Bureau of Maintenance. 1977. Control of access driveways, July 1977.

NJ Office of Business Advocacy. 1979. Directory of State programs for regulating construction, revised March 1979.

Reese, John. 1981. NJDEP, Division of Environmental Quality, Bureau of Air Pollution Control: personal communication, October 1981.

USEPA. 1980. Prevention of Significant Deterioration: workshop manual.

USEPA, Office of Water Planning and Standards. 1979. A guide to the dredge or fill permit program, July 1979.

APPENDIX C. PERMITS AND APPROVALS REQUIRED FOR THE PROPOSED EAST BRUNSWICK RESOURCE RECOVERY FACILITY

Although the permits listed in appendix B are necessary for a resource recovery facility anywhere in the state, there are specifics to the site, to the Township of East Brunswick, and to Middlesex County that also involve federal, state, and local permits. Facts specific to the Edgeboro site and East Brunswick are detailed here in connection with the following permits:

Solid Waste Facility Registration
US Army Corps of Engineers Permits
Flood Zone Permits
Water Quality Permits
County Sewer Tie-in Approval
Local Permits

SOLID WASTE FACILITY REGISTRATION— RESOURCE RECOVERY FACILITY

The East Brunswick resource recovery facility will have to be agreed to by the Middlesex County Freeholders before the NJ Solid Waste Administration will give its approval. Concurrently, the Middlesex County Department of Solid Waste Management will conduct a detailed review, including site visits. All involved municipalities will be invited to participate. It is understood that, as with other facility reviews, the Solid Waste Facility Registration will not be issued until the county's concerns have been met or withdrawn.

SOLID WASTE FACILITY REGISTRATION AND US ARMY CORPS OF ENGINEERS PERMITS— TRANSFER STATION

Several permits are required for the transfer stations and barging planned for the East Brunswick resource recovery facility. The NJ Solid Waste Administration acts as the lead agency, requiring application for a truck-to-barge transfer station separately from the resource recovery facility application. The permits associated with constructing the station (transportation permits, water quality permits, soil erosion and sediment control certificate, etc.) must also be obtained from the appropriate agencies. Furthermore, the East Brunswick facility plan calls for barging the waste from point to point up the Raritan River. The US Army Corps of Engineers must be notified to maintain the channel. Permits to build docks and dredge shore-to-mainstream channels must be obtained from the Corps. Stream Encroachment and Waterfront Development Permits, as well as a Water Quality Certificate (associated with dredging), will be required by NJDEP.

The Raritan River Channel

The portion of the Raritan River near the East Brunswick site is part of the thousands of miles of navigable waterway that is dredged and maintained by the US Army Corps of Engineers. The project dimensions on the National Oceanic and Atmospheric Administration (NOAA) maps are the depths at which the channel should be maintained. However, past Red Root Reach (east of the site), the traffic has been minimal and the need to dredge has not been established. There has been no dredging of that part of the river recently. Therefore, if the resource recovery facility is approved, the Corps should be notified of the project and its scope so that maintenance of that part of the river can be initiated. Near the Edgeboro site, the channel at the mouth of the Washington Canal is designated on the NOAA maps to be 10 feet deep, as is the channel at the mouth of the South River. However, a barge that draws 10 feet (the draft specified for this project) could run aground at low tide. The Army Corps had three suggestions for avoiding this possibility:

- make the barge lighter so as not to draw as much water
- have barge traffic only when the tides would allow sure passage
- increase the channel depth. This would require authorization of project plans and funding by Congress and could take a considerable amount of time.

Although the small amount of traffic on the upper part of the river does not warrant dredging now, the Corps indicated that barge traffic two to three times a day would probably justify dredging. Because funds and manpower are limited, new dredging projects are approved on a priority basis. The Corps must be given sufficient reason to give this project a high priority.

The owner of the facility (or facilities) takes on the responsibility for dredging the waterway between the channel and the dock at the transfer stations or the resource recovery facility. The owner also has the responsibility for obtaining proper permits from the Corps and the state.

Barge traffic may encounter problems in the winter months. The Raritan River freezes in winter months in parts of the barge's route to the resource recovery facility. Depending upon the severity of the winter, the ice cover could be considerable. Coast Guard icebreakers do not patrol the Raritan River. Conversations with the Corps indicate that no records of ice cover have been kept.

To speed the permitting process, one can request a determination if there is some question about the site, dredging, or critical areas. This is not a formal application and is not binding, but the Corps can look over plans, maps, and a description of work to be done in the waterways to determine necessary action and foresee problems before the application stage.

Because the sites for the resource recovery facility and the transfer stations are north of the Manasquan River, inquiries should be made to

Operational Division
US Army Corps of Engineers
NY District
26 Federal Plaza
New York, NY 10007

WATER QUALITY PERMITS

As mentioned in appendix B, all waterways in the state are classified according to current water quality and assigned designated uses and quality criteria: fresh water, tidal water, or coastal water. Streams are also classified as Trout Production, Trout Maintenance, and Nontrout streams. The most stringent water quality criteria are applied to the Trout Production streams and the least stringent to Nontrout streams. Water classification determines substances that can and cannot be discharged into the stream under the NPDES permits.

The waters on or near the Edgeboro site in the Raritan River basin are classified as TW-1 (Tidal Waters Class 1). The regulations describe their designated uses as follows:

- shellfish harvesting where permitted
- maintenance, migration, and propagation of natural and established biota
- primary contact recreation
- industrial and agricultural water supply

Possible transfer station sites are on the Arthur Kill, which is classified as TW-2 (Tidal Waters Class 2). Its designated uses include:

- secondary contact recreation
- propagation and maintenance of fish populations
- migrations of anadromous fish
- maintenance of wildlife

FLOOD ZONE PERMITS

Contact with NJDEP's Division of Water Resources, Bureau of Floodplain Management, results in a Delineation of Floodway Map for the Edgeboro site. The area of the site is found on maps showing Station 480 to Station 640, January 1978. The site, according to the map, appears to be primarily above the 500-year flood line, with the southeastern portion of the site in either the floodway or the flood fringe area. Development in either of these critical areas requires special modifications of the Site Plan application to include the location of the floodway and the flood fringe, existing use and vegetation, and soil type information. If it is found that the proposed site encroaches on a flood hazard area, the site plan application must be forwarded to the Division of Water Resources and the Environmental Commission for a report and recommendation. The application may in turn be passed on to the Drainage Basin Commission, the Middlesex County Planning Board, and the East Brunswick Township Engineer. The proposed resource recovery facility may be located in the flood hazard area. It can be assumed that any truck-to-barge transfer station would be located in the floodway.

In relation to the NJDEP regulations, the Township of East Brunswick has mapped out a coastal zone designation in its Waterfront District Plan. Mapping lines are drawn a minimum of 100 feet and a maximum of 500 feet from the mean high water line to the nearest road. Any construction requires a Waterfront Development Permit from the Division of Water Resources, NJDEP. This permit will be needed for the proposed RRF as well as any truck-to-barge transfer stations.

COUNTY SEWER TIE-IN APPROVAL

The size and the type of sewage treatment plant determine the pretreatment standards for industrial waste. The pretreatment standards for the Middlesex County Utilities Authority are listed in table C-1.

Table C-1. Pretreatment standards (ppm)— Middlesex County Utilities Authority

Suspended solids	300
Biological oxygen demand	300
Chlorine demand	15
Phosphorous	15
Nitrogen	40

Source:

LOCAL PERMITS

The Code of the Township of East Brunswick provides for a special Site Plan Review Committee to review development applications.

Plans and information submitted by the applicant should enable the committee to review the following:

- o preservation of existing natural resources on the site
- o provision for safe and effcient vehicular and pedestrian circulation, parking, and loading
- o screening, landscaping, and location of structures
- o provision for exterior lighting needed for safety
- o provision of water, energy, and other utilities
- o handling of stormwater drainage
- o removal of solid and liquid waste
- o handling of on-site nuisances such as noise, odor, air pollution, vibration, and toxic materials

Public notice is required for all applications for development and is to be given in the official newspaper of the township. Special notice is to be given to owners of all property within 200 feet in all directions and to:

- o the County Planning Board
- o the Commissioner of the NJ Department of Transportation
- o the NJ Department of Community Affairs (development over 150 acres)
- o the Soil Conservation District office (development over 5,000 square feet)
- o the commissioner of the NJ Department of Environmental Protection

Before a building or construction permit can be issued, the site plan must receive approval from the planning board. The proposed site for the Edgeboro facility is in an M-3 Heavy Industrial Zone. The facility meets the requirements of allowed industry in this zoned area, but specific site plan requirements must also be met.

A considerable amount of information is required in a thorough site plan, and those submitted to the Township of East Brunswick must include (at least):

- survey of property
- location of buildings, roads, bridges, etc.
- names of all owners of all adjoining properties
- identification of all existing schools, zoning and special district boundaries within 200 feet
- distance to nearest intersection
- location of existing and proposed storm drainage structure and utility lines
- proposed use of land and buildings, including outdoor storage
- description of traffic and parking patterns
- description of outdoor lighting (direction and intensity)
- description of proposed screening and landscaping
- sketch of proposed buildings
- list of deed restrictions, if any
- name, address, professional license number, and seal of architect, land planner, or surveyor preparing the site plan

The Director of Planning and Community Development may request more detailed information:

- existing contours and slopes over 3 percent (existing and final grades marked)
- location of rock outcroppings, ponds, marshes, and other significant features
- proposed easements

Within 45 or 95 days (depending upon the size of the project), the planning board must decide whether the site plan complies with the standards and regulations for the following: building, stormwater flow, screening areas, outdoor lighting intensity, and parking and traffic flow standards.

SOURCES

Department of the Army, Office of the Chief of Engineers. 1977. U.S. Army Corps of Engineers permit program: a guide for applicants. EP 1145-2-1, November 1977.

General Services Administration. 1977. Federal guidelines, state and local pretreatment programs.

NJDEP, Division of Coastal Resources. 1980. New Jersey coastal management program: summary and management system.

NJDEP Solid Waste Administration. n.d. Engineering plan requirements for transfer station.

USEPA, Office of Water Planning and Standards. 1979. A guide to the dredge or fill permit program, July 1979.

APPENDIX D

Chapter 42

AIR POLLUTION CONTROL

(HISTORY: Adopted by the Township Council of the Township of East Brunswick 7-12-71 as Ord. No. 71-14-E, as amended 9-27-71 by Ord. No. 71-14-G, as Sec. 11-13 of the Revised General Ordinances. Section 42-9A amended at time of adoption of Code; see Ch. 1, General Provisions, Art. I. Other amendments noted where applicable.)

GENERAL REFERENCES

Administration of government - See Ch. 3.
Commercial property maintenance - See Ch. 72.
Fire prevention - See Ch. 101.
Garbage, rubbish and refuse - See Ch. 114.
Public health nuisances - See Ch. 150.

& 42-1. Title

This chapter shall be known and may be cited as the "Air Pollution Control Code of the Township of East Brunswick."

& 42-2. Legislative findings and declaration of policy.

It is hereby declared that pollution of the atmosphere by smoke, cinders, soot, fly ash, gases, fumes, vapors, odors, dust and other contaminants is a menace to the health, welfare and comfort of the residents of East Brunswick Township and a cause of substantial damage to property. For the purpose of controlling and reducing atmospheric pollution, it is hereby declared to be the policy of the Township of East Brunswick to minimize air pollution as herein defined and to prohibit excessive emission of the same, to establish standards governing the installation, maintenance and operation of equipment and appurtenances relating to combustion which are a source or potential source of air pollution and, in furtherance of this purpose, to cooperate and coordinate these efforts with the State Department of Health, Air Pollution Control Program.

& 42-3. Definitions.

As used in this chapter, the following terms shall have the meanings indicated unless a different meaning clearly appears from the context:

AIR POLLUTION - The presence in the outdoor atmosphere of one (1) or more air contaminants in such quantities and duration as are or tend to be injurious to human health or welfare, to animal or plant life or to property, or would unreasonably interfere with the enjoyment of life or property throughout the Township of East Brunswick and in such territories of the township as shall be affected hereby and excludes all aspect of employer-employee relationship as to health and safety hazards.

BTU - An abbreviation meaning British Thermal Unit. A measure of heat energy normally expressed in btu's per hour.

DIRECT HEAT EXCHANGER - Equipment in which heat from the combustion of fuel is transferred to a substance being heated so that the latter is contacted by the products of combustion and may contribute to the total effluent.

ECONOMIC POISONS - Chemicals used as insecticides, rodentcides, fungicides, herbicides, mematocides or defoliants.

ENVIRONMENTAL AND HEALTH IMPACT STATEMENT - A statement as to the realistically identifiable, probable impact of the proposed facility upon the geology, soils, hydrology, air quality, ecology, land use, socioeconomics, aesthetics, history and archeology; a listing of adverse environmental impacts which cannot be avoided; a description of the steps to be taken to minimize adverse environmental impacts during construction and operation both at the project site and in the surrounding region; a listing of alternatives to all or any part of the project with reasons for their acceptabilty or nonacceptability; and a reference list of pertinent published information relating to the project, the project site and the surrounding region.

EQUIPMENT - Any device capable of causing the emission of an air contaminent into the open air and any stack, chimney, conduit, flu, duct, vent or similar device connected or attached to, or serving the equipment. This shall include equipment in which the proponderants of the air contaminents emitted is caused by the manufacturing process.

FUEL - Solid, liquid or gaseous materials used to produce useful heat by burning.

FUEL-BURNING EQUIPMENT - Any furnace, boiler, water heater, device, mechanism, stoker, burner, stack oven, stove, kiln, still or other apparatus, or a group or collections of such units in the pocess of fuel-burning for the generation of heat or power. Refuse-burning equipment shall be considered incinerators as herein defined and not included herein. *Ovens, stoves or ranges used exclusively for domestic cooking purposes, as well as furnaces, boilers, water heaters, fire places and wood burning stoves which are used exclusively for residential heating are not included herein.*

GARBAGE - Vegetable matter and animal matter, exclusive of body waste, originating in houses, kitchens, restaurants, hotels and other food establishments.

HAZARDOUS WASTE - Any solid waste or combination of solid wastes, including toxic, corrosive, irritating, sensitizing, radioactive, biologically infestious, explosive or flammable solid waste which poses a present or potential threat to human health, living organisms or the environment, provided that the solid waste has been designated hazardous in accordance with the standards and procedures set forth in N.J.A.C. 7:26-8.1 et. seq.

INCINERATOR - Any device, apparatus, equipment or structure used for destroying, reducing or salvaging by fire any material or substance, including but not limited to refuse, rubbish, garbage, debris or scrap, or facilities for cremating human or animal remains excluding those wastes designated by USEPA and/or NJDEP as hazardous, toxic or radioactive wastes.

INDIRECT HEAT EXCHANGER - Equipment in which heat from the combustion of fuel is transferred by conduction through a heat conducting material to a substance being heated, so that the latter is not contacted by and adds nothing to the products of combustion.

INFECTIOUS WASTE means the following:

1. Equipment, instruments, utensils and fomites (any substances that may harbor or transmit pathogenic organisms) of a disposable nature from the rooms of patients who are suspected to have or have been diagnosed as having a communicable disease and must, therefore, be isolated as required by public health agencies;

2. Laboratory wastes including pathological specimens (that is, all tissues, specimens of blood elements, excreta and secretions obtained from patients or laboratory animals) and disposable fomites attendant thereto;

3. Surgical operating room pathologic specimens and disposable fomites attendant thereto and similar disposable materials from outpatient areas and emergency rooms.

INTERNAL CROSS SECTIONAL DIMENSION - Any maximum linear perpendicular distance from an inside wall of a stack or chimney to the inside of an opposite wall, such as the diameter of a circular cross section or the length or width of a rectangular cross section.

LIQUID PARTICLES - Particles which have volume but are not of rigid shape and which upon collection tend to coalesce and create uniform homogeneous films upon the surface of the collecting media.

MANIFEST - The hazardous waste manifest form approved for use by the Department of Environmental Protection.

MANUFACTURING PROCESS - Any action, operational treatment embracing chemicals, industrial, manufacturing, or processing factors, methods or forms including, but not limited to, furnaces, kettles, ovens, convertors, cupolas, kilns, crucibles, stills, dryers, roasters, crunchers, grinders, mixers, reactors, regenerators, separaters, filters, reboilers, columns, classifiers, screens, quenchers, cookers, digestors, towers, washers, scrubbers, mills, condensors, or absorbers.

MARINE INSTALLATION - Equipment for propulsion, power or heating on all types of marine craft and floating equipment.

MOBILE SOURCE - Equipment designed or constructed to be portable or moveable from one location to another including, but not limited to, air craft, locomotives operating on rails, tractors, earth moving equipment, hoists and mobile powered generators.

MOTOR VEHICLE - Any vehicle propelled otherwise than by muscular power excepting such vehicles as run only upon rails or tracks.

MUNICIPAL SOLID WASTE - residential, commercial and institutional solid waste generated within a community not including hazardous or toxic wastes.

ODOR - A property of a substance which affect the sense of smell.

OPACITY - The property of a substance which renders it partially or wholely obstructive in the transmission of visible light, expressed as the percentage to which the light is obstructed.

OPEN BURNING - Any fire wherein the products of combustion are emitted into the open air and are not directed thereto through a stack or chimney.

OPERATOR - Any person who has care, custody or control of a building or premises or a portion thereof, whether with or without knowledge of the owner thereof.

OWNER - Any person who, alone or jointly or severally with others, shall have legal or equitable title to any premises, with or without accompanying actual possession thereof; or who shall have charge, care or control of any premises or part thereof, including but not limited to a dwelling or dwelling unit, as owner or agent of the owner or as a fiduciary, including but not limited to executor, administrator, trustee, receiver, guardian or as a mortgagee in possession regardless of how such possession was obtained. Any person who is a lessee or sublessee of all or any part of any premises, including but not limited to a dwelling or dwelling unit, shall be deemed to be a co-owner with the lessor and shall have joint responsibility with the owner over the premises or portion thereof so leased or subleased.

PARTICLES - Any material except uncombined water, which exists in finely divided form as liquid particles or solid particles at standard conditions.

PATHOLOGICAL WASTE - See Infectious Waste.

PERSON - An individual, trust, firm, joint stock company, Federal Agency, corporation (including a government corporation), corporate official, partnership, association, State, municipality, commission, political subdivision of a State, or any interstate body.

POTENTIAL EMISSION RATE - The mass rate of air contaminent emitted or to be emitted through a stack or chimney to the outdoor air exclusive of any type of control apparatus.

PPM - (Parts per million) A measure of the concentration of an air contaminant in a given air sample, can also be expressed as 1 milligram per liter.

PUTRESCIBLE WASTE - Any waste liable to enter into a state or putrefaction, the typically anaerobic splitting of proteins by bacteria and fungi with the formation of foul-smelling, incompletely oxidized products.

RADIOACTIVE WASTES - Any material which inherently or by virtue of its contact with a radioactive substance emits radioactivity and therefore comes under the jurisdiction and requirements of the USEPA, NJDEP or Federal Nuclear Regulatory Agency.

RECYCLING FACILITY - Any place, equipment or plant designed and/or operated to collect, store, process or to redistribute separated waste so as to return the material to market.

REFUSE - (See also "garbage".) All putrescible and nonputrescible wastes, except body wastes, and shall include but not be limited to garbage, rubbish, yard trimmings, leaves, ashes, street cleanings, dead animals, abandoned automobiles and solid market and industrial wastes excluding wastes which are considered hazardous, toxic or radioactive.

RESIDUE - Any material that remains after completion of thermal, mechanical or chemical processing.

RESOURCE RECOVERY FACILITY - Any place, equipment, device or plant designed and/or operated to separate or process solid or liquid waste into usable secondary materials, including fuel and energy.

RINGELMANN SMOKE CHART - Ringelmann's Scale for Grading the Density of Smoke, published by the United States Bureau of Mines, or any chart, recorder, indicator or device for the measurement of smoke density which is approved by the State Department of Health of the State of New Jersey, as the equivalent of said Ringelmann's Scale.

RUBBISH - Solids not considered to be highly flammable or explosive, and shall include but not be limited to rags, old clothes, leather, rubber, carpets, wood, excelsior, paper, ashes, tree branches, yard trimmings, furniture, tin cans, glass, crockery, masonry and other similar materials.

SALVAGE OPERATIONS - Any business, trade or industry engaged in whole or in part in salvaging or reclaiming any product or material, including but not limited to metals, chemicals, shipping containers or drums.

SEPTIC WASTE - A mixture consisting of solid matter suspended in a liquid media (for example, a slurry).

SEWAGE SLUDGE - The solid residue consisting of sewage solids combined with water and dissolved materials in varying amount.

SLUDGE - Any solid, semi-solid or liquid waste generated from a municipal, commercial, or industrial wastewater treatment plant, water supply treatment plant or air pollution control faclity exclusive of the treated effluent from a wastewater treatment plant.

SMOKE - Small gasborne and airborne particles arising from a process of combustion in sufficient number to be observable.

SOLID WASTE - See N.J.A.C. 7:26-1.6

SOLID WASTE CARRIER - Any person or persons licensed to transport municipal solid waste by the appropriate state agency.

SOURCE GAS - Air or gases passed through, or generated by, a source operation and discharged from the source operation.

STACK OR CHIMNEY - A flu, conduit or opening designed and constructed for the purpose of emitting air contaminants into the outdoor air.

STANDARD TEMPERATURE AND PRESSURE - 0 degrees centigrade and 1,013 millibars or 32 degrees fahrenheit and 14.69 pounds per square inch absolute.

TRADE WASTE - Any all solid or liquid material or rubbish resulting from construction, building operations, or prosecution of any business, trade or industry and shall include, but not be limited to, plastic products, carton, paint, grease, oil and other petroleum products, chemicals, cinders and other forms of solid or liquid waste materials.

VISIBLE SMOKE - Smoke which obscures light to a degree readily decernable by the visual operation.

& 42-4. Restrictions on open burning.

A. No person shall cause, suffer, allow or permit open burning of refuse or plant life nor conduct a salvage operation by open burning.

& 42-5. Restrictions on emissions from *fuel* burning equipment.

*1. Restrictions on emissions from stationary indirect heat enchangers

A. Smoke emissions. No person shall cause, suffer, allow or permit visible smoke to be emitted into the outdoor air from the combustion of fuel in any stationary direct or indirect heat exchanger having a rated hourly capacity of less than 200 million btu gross heat input discharging through a stack or chimney having an internal cross sectional dimension of less than 60 inches.*

B. No person shall cause, suffer, allow or permit smoke a shade or appearance of which is darker than No. 1 on the Ringelmann Smoke Chart or greater than twenty (20%) percent opacity, exclusive of water vapor to be emitted into the outdoor air from the combustion of fuel in any stationary indirect or direct heat exchanger having a rated hourly capacity of 200 million btu or greater gross heat input discharing through a stack or chimney having an internal cross sectional dimension of 60 inches or greater.

C. *Provisions of Section A and B of Section 42-5.1 shall not apply to smoke which is visible for a period of not longer than three (3) minutes in any consecutive thirty (30) minute period.*

*2. Restrictions on emissions from marine installations

A. Smoke emissions. No person shall cause, suffer, allow or permit smoke the shade or appearance of which is darker than the No. 1 on the Ringelmann Smoke Chart of greater than thirty (30%) percent opacity exclusive of water vapor, to be emitted into the outdoor air from the combustion of fuel in the indirect heat exchanger in any marine installation.

B. The provisions of Section 42-5.2A shall not apply to smoke which is visible for a period not longer than three (3) minutes in any consecutive thirty (30) minute period.*

*3. *Restrictions on emissions from combustion of fuel in mobile sources.

A. No person shall cause, suffer, allow or permit smoke the shade or appearance of which is darker than the No. 2 on the Ringelmann Smoke Chart or greater than forty (40%) percent opacity exclusive of water vapor to be emitted into the outdoor air from the combustion of fuel in any mobile source for a period of more than ten consecutive seconds.

4. Restrictions on emissions from stationary internal combustion engines and stationary turbine engines

A. No person shall cause, suffer, allow or permit smoke the shade or appearance of which is darker than No. 1 on the Ringelmann Smoke Chart or greater than twenty (20%) percent opacity exclusive of water vapor to be emitted into the outdoor air from the combustion of any fuel in any stationary internal combustion engine or any stationary turbine engine for a period of more than ten consecutive seconds.

*& 42-5.5 Exceptions

Provisions of this section shall not apply to any motor vehicle while operating upon public highways.*

& 42-6. Restrictions on emissions from incinerators.

1.A. Smoke emissions. No person shall cause, suffer, allow or permit smoke from any incinerator, the shade or appearance of which is darker than No. 1 of the Ringelmann Smoke Chart, to be emitted into the open air; or emissions of such opacity within a stack or chimney exclusive of water vapor, to a degree greater than the emission designated as No. 1 of the Ringelmann Smoke Chart.

B. The provisions of this section shall not apply to smoke emitted during the cleaning of a firebox or the building of a new fire, the shade or appearance of which is not darker than No. 2 of the Ringelmann Smoke Chart.

2. Emissions from these facilities shall be treated to obtain exhaust stack gases to meet or exceed the following parameters:

Particulates	.1 ppm
Hydrochloric Acid	.1 ppm*
Sufides	.1 ppm
Hydrofluric Acid	.005 ppm*
Carbon Monoxide	1 ppm*

*These values are to be corrected for an (oxygen) O_2 content of 11% by volume and referred to standard conditions of temperature and pressure.

3. In the case of a refuse burning plant, the following shall apply:

A. The facilities must provide an afterburning chamber which opens into the combustion chamber, or is located downwind from it, so that waste gases can be retained in it for at least 0.3 seconds at a minimum temperature of 800 ° C (1,472 ° F) and a minimum 0_2 concentration of 6% by volume. This temperature is to be monitored by continuously recording instrumentation. The facilities must be laid out in such a manner that waste charging is only possible when this minimum temperature has been reached. A supplemental burner needs to be installed in the afterburning chamber which turns on automatically as soon as the temperature dops below the allowable minimum. Such afterburning needs to take place even if the facility is not in operation and the air drawn off the refuse storage pit is vented through the afterburning chamber.

B. The refuse storage area must be kept below atmospheric pressure; the air which is drawn off shall be fed to the furnace. In the case of facilities intended for continuous operation, if the furnace is temporarily shut down, (for example, as the result of equipment malfunction), then the drawn-off air must be vented via the stack.

C. The facilities shall be operated in such a manner that the highest degree of burnout possible is guaranteed for the waste gases and any fermentable components entrained in them.

D. Particulate emissions in the wet waste gases may not exceed .1 ppm corrected for an 0 content of 11% by volume and referred to standard conditions of temperature and pressure (0 C and 1,013 mbar or 32 F and 14.69 psia)

E. The facilities must be equipped with a supplemental firing system.

F. All facilities must be connected to a stack.

G. The sum of all organic emissions (unburnt hydrocarbons) shall not exceed .3 ppm.

H. Liquid wastes may not be burned in a resource recovery facility in this municipality unless a specific waiver to this provision is obtained in writing from the officer appointed by the governing body to enforce this ordinance. In no case may the waste burned be categorized by this code as toxic or by its destruction release by products that are considered toxic or hazardous.

* I. The burning of economic poisons and trade waste is specifically forbidden.*

4. Odors. No person shall construct, install, use or cause to be used any incinerator which will result in odors being detectable by sense of smell in any area of human use or occupancy.

& 42-7. Air pollution prohibited.

No person or owner of property and no person having possession or control of property shall cause, suffer, allow or permit to be emitted into the open air substances in such quantities as shall result in air pollution. The provisions of this section shall not apply to the use of economic poisons.

*& 42-8. Mechanical breakdown or scheduled maintenance:

1 Operation of any fuel burning equipment or incinerators as to cause emissions in excess of limits set by this ordinance which is in a direct result of mechanical breakdown or is a direct result of the shutdown of such equipment or scheduled maintenance, is not a violation of this ordinance, provided:*

* A. The occurence has been reported to the Department of Health and Welfare at least 24 hours before any scheduled maintenance, and the scheduled maintenance is performed where possible during times as specified by the Department of Health and Welfare and favorable for atmospheric ventilation; or

B. Occurence has been reported to the Department of Health and Welfare as soon as reasonably possible in the case of a mechanical breakdown, but in no case more than one hour after the occurence.

C. Repairs are made with a maximum reasonable effort; and

D. In the event of emission of air contaminent to the nature or in quantity which would endanger public health or safety, such emission is stopped entirely or reduced to harmless levels as soon as possible; and

E. Mechanical breakdowns do not occur with such frequency as a careless marginal, or unsafe operation is indicated.*

& 42-9. Inspections; right of entry.

A. All buildings and premises subject to this chapter are subject to inspection from time to time by the Director of Health and Welfare or his duly authorized representatives. All rooms and areas in the building shall be available and accessible for such inspection which shall be made during usual business hours if the premises is used for nonresidential purposes; provided, however, that inspections may be made at other times if:

(1) The premises is not available during rhe foregoing hours for inspection;

(2) There is reason to believe that violations are occurring on the premises which can only be apprehended and proved by inspection during other than the prescribed hours; or

(3) There is reason to believe a violation exists of a character which is an immediate threat to health or safety requiring inspection and abatement without delay.

B. Emergency inspections may be authorized without warrant if the Director of Health and Welfare has reason to believe that a condition exists which poses an immediate threat to life, health or safety. Such procedure shall take place only where the time required to apply for and secure the issuance of a warrant would render ineffective the immediate action necessary to abate the condition. Emergency inspections may also be authorized by the Governor in times of air pollution emergencies in accordance with N.J.R.S. 26:2C-32. Where the Director of Health and Welfare or his duly authorized representative is prevented by the owner, occupant or operator from conducting an inspection of the premises, such person shall be in violation of this chapter and subject to the penalties hereunder.

C. Search warrant or access warrant.

(1) The Director of Health and Welfare may, upon affidavit, apply to the Judge of the Municipal Court of the Township of East Brunswick for a search warrant setting forth factually the actual conditions and circumstances that provide a reasonable basis for believing that a nuisance or violation of this chapter may exist on the premises, including one (1) or more of the following:

(a) That the premises requires inspection according to the cycle established by the Director of Health and Welfare for periodic inspections of premises of the type involved.

(b) That observation of external conditions (for example, smoke, ash, soot or odors) of the premises and its public areas has resulted in the belief that violations of this chapter exist.

(c) Circumstances such as age and design of fuel-burning equipment and/or system, types of incinerator, particular use of premises or other factors which render systematic inspections of such buildings necessary in the interest of public health and safety.

(2) If the Judge of the Municipal Court of the Township of East Brunswick is satisfied as to the matters set forth in the said affidavit, he shall authorize the issuance of a search warrant permitting access to an inspection of that part of the premises on which the nuisance or violation may exist.

D. All facilities which fall under the jurisdiction of this code shall be required to monitor continuously and keep a permanent record of emission temperature and emission composition. This shall take place at the following locations:

(1) Temperature

(a) In the combustion chamber.

(b) In the exhaust prior to Air Pollution Control Devices.

(c) In the exhaust after the Air Pollution Control Devices.

(d) In the stack prior to release to the atmosphere.

(2) Gaseous/particulate emissions

(a) Prior to the A.P.C.

(b) After the A.P.C.

E. The emissions which shall be continually monitored at the locations specified in 42.7.D-2 at a minimum shall be:

(1) Particulates.

(2) Hydrochloric Acid (HCl)

(3) Hydrofloric Acid (HF)

(4) Sulfides (SO_2)

(5) Carbon Monoxide (CO)

(6) Oxygen (O_2)

(7) Carbon Dioxide (CO_2)

(8) Velocity

(9) Unburned Hydrocarbons

Other tests may be mandated on a monthly or quarterly basis if the need for further information is needed.

F. The facilities which fall under this code shall be responsible to install the monitoring devices where required and to provide two (2) recording devices which shall become the property of the municipality. The recording devices shall be capable of making a permanent record (paper), such record to be submitted to the municipality at set intervals. One (1) recording device shall always be in the possession of the office of the official of the municipality appointed to monitor the facility. The municipality reserves the right to substitute the recording machine in their possession for the one on-line in the facility without prior notice to the facility. This shall be done periodically but not less than once every three (3) months. The facility shall be responsible for the up-keep and maintenance of the monitoring probes, contacts, etc. Failure to do so shall constitute a violation of this section.

& 42-10. Permit Required.

1. No person shall operate and no owner or operator of any building in the Township of East Brunswick shall permit the operation of an incinerator without a duly issued permit issued by the Board of Health on recommendation of the agent appointed by the Township in accordance with this section. On applications for facilities not constructed prior to the adoption of this ordinance shall submit an E. I. & H. statement in addition to other needed documentation.

A. Application Procedure

Applications for permits to operate incinerators shall be made on forms provided by the agent appointed by the Township and shall provide such information as may be necessary to determine the nature of the installation, safety and fire protection devices, design and devices sufficient to insure against air pollution devices, necessary information as to person or persons responsible for operation and for maintenance and qualifications therefor and such other pertinent information as may be necessary for protection of the public welfare, safety, health and interest.

B. Recommendations as to Issuance: Conditions: Issuance Fee: Expiration Date

The agent appointed by the Township shall recommend issuance of a permit for the operation of an incinerator after examining the application and inspecting the facility and being satisfied that it may be operated in accordance with this Section. Such permit may be conditioned on improvements being made within a prescribed time or on certain operating restrictions if necessary to comply with this Section. All permits shall be issued by the Board of Health and shall expire one year following their issuance or at such time prior thereto as any conditions or restrictions shall not be complied with. The annual fee for each incinerator shall be twenty-five dollars, payable to the Township of East Brunswick.

C. Sealing of Incinerator Operated Without Permit

The agent appointed by the Township may take all necessary steps to seal any incinerator which has been operated without a duly authorized permit issued pursuant to this Section.

*& 42-11. *Limitation on time of operation.*

No person shall operate and no owner or operator of any building in the Township of East Brunswick shall permit the operation of an incinerator prior to 7:00 a.m. or after 5:00 p.m. on any day, and all operations shall be completely terminated by 5:00 p.m., including complete extinction of the fire and removal of the material in a safe manner from the fire box to a noncombustible container; provided, however, that by special permit, the agency may, because of exceptional circumstances, permit different hours of operation under such conditions as shall be deemed necessary for the health, safety and welfare of the public or persons in the vicinity.*

*& 42-12. Injunction against violations.

1. If any person violates any of the provisions of this code, the Department of Health and Welfare may institute a civil action in the Superior Court of New Jersey on relation of the Department of Health and Welfare, for injunctive relief to prohibit and present the continuance of such violation or violations.*

& 42-13. Violations and penalties.

A. Any person who shall violate any of the provisions of this chapter, or who shall fail to comply herewith or with any of the requirements thereof, shall be punishable as provided for in Chapter 1, General Provisions, Article I.[1]

B. The violation of any section or subsection of this chapter shall constitute a separate and distinct offense independent of the violation of any other section or subsection, or of any order issued pursuant to this chapter. Each day of violations shall constitute an additional, separate and distinct violation.

*& 42-14. Construction and Separability.

1. This code is to be liberally construed to effecutate the purposes herein described. Nothing herein is to be construed as repealing or bridging the emergency powers of any agency or government except to the extent expressly set forth herin.

2. If any section, subsection, paragraph, sentence, clause, phrase, or portion of this ordinance shall be judged invalid for any reason what so ever, such portions shall be deemed a separate, distinct and independent provision, and such holding shall not effect the validity of the remaining portions hereof which shall remain in full force and effect.*

APPENDIX E

(DRAFT COPY - FEBRUARY 10, 1982)

THE NOISE CONTROL ORDINANCE FOR THE TOWNSHIP OF EAST BRUNSWICK COUNTY OF MIDDLESEX, STATE OF NEW JERSEY

ARTICLE I SHORT TITLE

This ordinance may be cited as the "NOISE CONTROL ORDINANCE" for the Township of East Brunswick.

ARTICLE II DECLARATION OF FINDINGS AND POLICY: SCOPE

2.1 WHEREAS excessive sound is a serious hazard to the public health and welfare, safety, and the quality of life; and,
WHEREAS a substantial body of science and technology exists by which excessive sound may be substantially abated; and,
WHEREAS the people have a right to and should be ensured an environment free from excessive sound that may jeopardize their health or welfare or safety or degrade the quality of life; and,
Now, THEREFORE, it is the policy of the Township of East Brunswick to prevent excessive sound which may jeopardize the health and welfare or safety of the citizens or degrade the quality of life.

2.2 This ordinance shall apply to the control of all sound originating within the limits of the Township of East Brunswick.

ARTICLE III DEFINITIONS

3.1 All terminology used in this ordinance, not defined below, shall be in conformance with applicable publications of the American National Standards Institute (A.N.S.I.) or its successor body.

3.2.1 "A-WEIGHTED SOUND LEVEL" MEANS
The sound pressure level in decibels as measured on a sound level meter using the A-weighting network. The level so read is designated db (A) or dBA.

3.2.2 "COMMERCIAL AREA" MEANS
(As defined in the community zoning ordinance).
(check definition)

3.2.3 "CONSTRUCTION" MEANS
Any site preparation, assembly, erection, substantial repair, alteration or similar action, but excluding demolition, for or of public or private right-of-way, structures, utilities or similar property.
(check definition)

3.2.4 "NOISE CONTROL OFFICE" MEANS
The municipal agency or department having lead responsibility for this ordinance which shall be the East Brunswick Department of Health, Environment and Welfare.

3.2.5 "DECIBEL (dB)" MEANS
A unit for measuring the volume of a sound, equal to 20 times the logarithm to the base 10 of the ratio of the pressure of the sound measured to the reference pressure which is 20 micropascals (20 micronewtons per square meter).

3.2.6 "DEMOLITION" MEANS
Any dismantling, intentional destruction or removal of structures, utilities, public or private right-of-way surfaces, or similar property.
(check definition) - ck, Building Code.)

3.2.7 "EMERGENCY" MEANS
Any occurrence or set of circumstances involving actual or imminent physical trauma or property damage which demands immediate action.
(check definition)

3.2.8 "EMERGENCY WORK' MEANS
Any work performed for the purpose of preventing or alleviating the physical trauma or property damage threatened or caused by an emergency.
(check definition)

3.2.9 "GROSS VEHICLE WEIGHT RATING (GVWR)" MEANS
The value specified by the manufacturer as the recommended maximum loaded weight of a single motor vehicle. In cases where trailers and tractors are separable, the gross combination weight rating (GCWR), which is the value specified by the manufacturer as the recommended maximum loaded weight of the combination vehicle, shall be used.

3.2.10 "IMPULSIVE SOUND" MEANS
Sound of short duration, usually less than one second, with an abrupt onset and rapid decay. Examples of sources of impulsive sound include but are not limited to explosions, drop forge impacts, bird controlling devices (clackers), and the discharge of firearms.

3.2.11 "INDUSTRIAL AREA" MEANS
(As defined in the Community Zoning Ordinance.)
(check definition)

3.2.12 "MOTOR CARRIER VEHICLE ENGAGED IN INTERSTATE COMMERCE" MEANS
Any vehicle for which regulations apply pursuant to Section 18 of the Federal Noise Control Act of 1972 (P.L. 92-574), as amended, pertaining to motor carriers engaged in interstate commerce.

3.2.13 "MOTOR VEHICLE" MEANS
As defined in the motor vehicle code of the State. Any vehicle which is propelled or drawn on land by a motor, such as, but not limited to, passenger cars, trucks, truck-trailers, semi-trailers, campers, go-carts, snow-mobiles, amphibious craft on land, dune buggies, or racing vehicles, but not including motor cycles.

3.2.14 "MOTORCYCLE" MEANS
As defined in the motor vehicle code of the State. An unenclosed motor vehicle having a saddle for the use of the operator and two or three wheels in contact with the ground, including, but not limited to, motor scooters, minibikes and mopeds.

3.2.15 "MUFFLER OR SOUND DISSIPATIVE DEVICE" MEANS
A device for abating sound.

3.2.16 "NOISE" MEANS
Any sound which annoys or disturbs humans, animals or wildlife or also any sound which causes or tends to cause an adverse psychological or physiological effect on humans, animals or wildlife.

3.2.17 "NOISE DISTURBANCE" MEANS
Any sound which:
(a) endangers or injures the safety or health of humans or animals, o:
(b) annoys or disturbs a reasonable person of normal sensitivities, o:
(c) endangers or injures personal or real property.

3.2.18 "PERSON" MEANS
Any individual, association, partnership, or corporation, and includes any officer, employee, department, agency or instrumentality of a State or any political subdivision of a State.

3.2.19 "PUBLIC RIGHT-OF-WAY" MEANS
Any street, avenue, boulevard, highway, sidewalk or alley or similar place which is owned or controlled by a governmental entity.
(check definition)

3.2.20 "PUBLIC SPACE" MEANS
Any real property or structures whereon which are owned or controlled by a governmental entity.
(check definition)

3.2.21 "REAL PROPERTY" MEANS
An imaginary line along the ground surface, and its vertical extension, which separates the real property owned by one person from that owned by another person, but not including intra-building real property divisions.
(check definition)

3.2.22 "RESIDENTIAL AREA" MEANS
As defined in the community zoning ordinance .
(check definition)

3.2.23 "RMS SOUND PRESSURE" MEANS
The square root of the time averaged square of the sound pressure denoted Prms.

3.2.24 "SOUND" MEANS
An oscillation in pressure, particle displacement, particle velocity or other physical parameter, in a medium with internal forces that causes compression and rarefaction of that medium. The description of sound may include any characteristic of such sound, including duration, intensity and frequency.

3.2.25 "SOUND LEVEL" MEANS
The weighted sound pressure level obtained by the use of a sound level meter and frequency weighting network, such as A, B, or C as specified in American National Standards Institute specifications for sound level meters (ANSI SI.4-1971, or the latest approved revision thereof). If the frequency weighting employed is not indicated, the A-weighting shall apply.

3.2.26 "SOUND LEVEL METER" MEANS
An instrument which includes a microphone, amplifier, RMS detecto: integrator or time averager, output meter, and weighting net work: used to measure sound pressure levels.

3.2.27 "SOUND PRESSURE" MEANS
The instantaneous difference between the actual pressure and the average or barometric pressure at a given point in space, as produced by sound energy.

3.2.28 "SOUND PRESSURE LEVEL" MEANS
20 times the logarithm to the base 10 of the ratio of the RMS sound pressure to the reference pressure of 20 micropascals ($20 \times 10^{-6} N/M^2$). The sound pressure level is denoted Lp or SPL and is expressed in decibels.

3.2.29 "WEEKDAY" MEANS
Any day Monday through Friday which is not a legal holiday.

ARTICLE IV POWERS AND DUTIES OF THE NOISE CONTROL OFFICE

4.1 The noise control program established by this ordinance shall be administered by the Noise Control Office which will have the overall responsibility to coordinate, implement and enforce this ordinance.

4.2 In order to implement and enforce this ordinance and for the general purpose of sound abatement and control, the Noise Control Office shall have, in addition to any other power vested in it, the power to:

4.2.1 Conduct, or cause to be conducted, research, monitoring, and other studies relating to sound.

4.2.2 Conduct programs to educate the public in connection with noise control and the provisions of this ordinance.

4.2.3 Coordinate the noise control activities of all municipal departments and cooperate with all other public bodies and agencies to the extent practicable.

4.2.4 Review the actions or programs of other municipal departments and advise such departments of the effect, if any, of such actions or programs on noise control.

4.2.5 Review public and private projects, subject to mandatory review or approval by other departments, for compliance with this ordinance, if such projects are likely to cause sound in violation of this ordinance.

4.2.6 Based on suspicion of violation of this ordinance or complaint and upon presentation of proper credentials, enter and inspect any private property or place, and inspect reports or records which may be related to the suspicion of violation at any reasonable time when granted permission by the owner, or by some other person with apparent authority to act for the owner. When permission is refused or cannot be obtained, a search warrant may be obtained from a court of competent jurisdiction upon showing of probable cause to believe that a violation of this ordinance may exist. Such inspection may include administration of any necessary tests. If the interests of the Township require, the Noise Control Office may designate some other qualified person (s), as defined in 4.2.8, to conduct such inspections.

4.2.7 Require the owner or operator of any commercial or industrial activity to measure the sound level from any source in accordance with the methods and procedures and at such locations and times as the Noise Control Office may reasonably prescribe and to furnish reports of the results of such measurement to the Noise Control Office. The Noise Control Office may require the measurements to be conducted in the presence of its enforcement officials. If a property owner or operator refuses to comply with the provisions of this paragraph, the sound measurements may be made pursuant to Section 4.2.6.

4.2.8 The Noise Control Office must have personnel trained in community noise measurement who have received certification through an approved training course offered at Rutgers University or a similarly approved program. Recertification of the Noise Control Office trained personnel must occur every two (2) years through the program at Rutgers University or a similarly approved program.

4.2.9 In those rare cases as deemed necessary, the Noise Control Office shall have the power to grant a written waiver of compliance for a specified period of time.

ARTICLE V DUTIES AND RESPONSIBILITIES OF OTHER DEPARTMENTS

5.1 All departments, particularly the Police Department and agencies of the Township of East Brunswick, shall, to the fullest extent consistent with other law, carry out their programs in such a manner as to further the policy of this ordinance, and shall cooperate with the Noise Control Office in the implementation and enforcement of this ordinance.

5.2 All departments charged with new projects or changes to existing projects that result, or may result in the production of sound shall consult with the Noise Control Office prior to the approval and/or initiation of such projects.

5.3 In case of motor vehicle enforcement, the Police Department shall be the primary enforcement agency.

The Police Department shall be empowered to stop any motor vehicle, or motorcycle, operated on a public right-of-way or public space when reasonably suspected of violating any provisions of this ordinance and issue a notice of violation or abatement order which may require the motor vehicle or motorcycle to be inspected or tested as the Noise Control Office may reasonably require.

ARTICLE VI PROHIBITED ACTS

6.1 No person shall make, continue or cause or permit to be made verbally or mechanically any unnecessary noise or noise disturbance. Non-commercial public speaking and public assembly activities conducted on any public space or public right-of-way shall be exempt from the operation of this Section.

6.2 The following acts, and the causing thereof, are declared to be in violation of this ordinance:

6.2.1 Sound Reproduction Systems
Operating, playing or permitting the operation or playing of any radio, television, phonograph or similar device which reproduces or amplifies sound:

(a) In such a manner as to create a noise disturbance at 50 feet (15 meters) from such device, when operated in or on a motor vehicle on a public right-of-way or public space.

6.2.2 Loudspeakers/Public Address Systems

(a) Using or operating for any purpose any loudspeaker, public address system or similar device between the hours of 10:00 P.M. and 8:00 A.M. the following day, in such a manner as to be audible across a residential real property boundary.

6.2.3 Loading and Unloading

Loading, unloading, opening, closing or other handling of boxes, crates, containers, building materials, or similar objects between the hours of 10:00 P.M. and 7:00 A.M. the following day pursuant to Article VII of this ordinance.

6.2.4 Construction

Operating or permitting the operation of any tools or equipment used in commercial construction, drilling, or demolition work:

(a) Between the hours of 8:00 P.M. and 7:00 A.M. the following day on weekdays, between the hours of 8:00 P.M. and 8:00 A.M. the following day on Saturday, or at any time on Sunday or holidays, such that the sound therefrom creates a noise disturbance across a residential real property boundary, except for emergency work of public service utilities or by special waiver issued pursuant to Article IV.

6.2.5 Stationary Non-emergency Signaling Devices

Control of noise from stationary non-emergency signaling device shall be in accordance with the provisions of N.J.A.C. 7:29-1.1 through 1.5 and all amendments and supplements thereto, which provisions are incorporated herein by reference.

6.2.6 Emergency Signaling Devices

Control of noise from emergency signaling devices shall be in accordance with the provisions of N.J.A.C. 7:29-1.1 through 1.5 and all amendments and supplements thereto, which provisions are incorporated herein by reference.

6.2.7 Refuse Compacting Vehicles

The operating or permitting to be operated of any motor vehicle which can compact refuse, between the hours of 8:00 P.M. and 7:00 A.M. the following day in residential areas.

ARTICLE VIII MAXIMUM PERMISSABLE SOUND LEVELS

7.1 No person shall operate or cause to be operated any source of sound in such a manner as to create a sound level which exceeds the limits set forth in Table 7.1.

TABLE 7.1 MAXIMUM PERMISSABLE SOUND LEVELS BY RECEIVING LAND USE CATEGORY

SOUND SOURCE LAND USE CATEGORY	RECEIVING LAND USE CATEGORY: RESIDENTIAL		COMMERCIAL	INDUSTRIAL
Residential	(7 A.M.-10 P.M.) (10 P.M.- 7 A.M.)	65 50	65	75
Commercial	(7A.M.-10 P.M.) (10 P.M.-7 A.M.)	65 50	65	75
Industrial	(7 A.M.-10 P.M.) (10 P.M.- 7 A.M.)	65 50	65	75

7.2 Exemptions

(a) Domestic power tools, lawn mowers, and agricultural equipment when operated with a muffler, between the hours of 7 A.M. to 10 P.M. on weekdays and 8 A.M. to 10 P.M. on weekends and holidays.

(b) Noise from church bells and chimes.

(c) Noise from construction activity, except as provided in 6.2.4.

(d) Authorized use of firearms.

ARTICLE VIII MOTOR VEHICLE MAXIMUM SOUND LEVELS

8.1 Motor Vehicles and Motorcycles on Public Rights-of Way
No person shall operate or cause to be operated a public or private motor vehicle or motorcycle on a public right-of-way at any time in such a manner that the sound level emitted by the motor vehicle or motorcycle exceeds the level set forth in Table 8.1.

TABLE 8.1 MOTOR VEHICLE AND MOTORCYCLE SOUND LIMITS (MEASURED AT 50 FEET OR 15 METERS)

Vehicle Class	SOUND LEVEL IN dBA		
	Speed Limit 35 MPH or Less	Speed Limit Over 35 MPH	Stationary Run-up
Motor carrier vehicle engaged in interstate commerce of GVWR or GCWR of 10,000 lbs. or more.	86	90	88
All other motor vehicles of GVWR or GCWR of 10,000 lbs. or more.	86	90	-
Any motorcycle.	82	86	-
Any other motor vehicle or any combination of vehicles towed by any motor vehicle.	76	82	-

8.1.1 Adequate Mufflers or Sound Dissipative Devices

(a) No person shall operate or cause to be operated any motor vehicle or motorcycle not equipped with a muffler or other sound dissipative device in good working order and in constant operation;

(b) No person shall remove or render inoperative, or cause to be removed or rendered inoperative, other than for purposes of maintenance, repair, or replacement, any muffler or sound dissipative device on a motor vehicle or motorcycle.

8.1.2 Motor Vehicle Horns and Signaling Devices

The following acts and the causing thereof are declared to be in violation of this ordinance:

(a) The sounding of any horn or other auditory signaling device on or in any motor vehicle or motorcycle on any public right-of-way or public space, except (as a warning of danger) as provided in the vehicle code.

(b) The sounding of any horn or other auditory signaling device which produces a sound level in excess of 100 dBA at 25 feet (7.6 meters).

8.1.3 Standing Motor Vehicles

No person shall operate or permit the operation of any motor vehicle with a gross vehicle weight rating (GVWR) in excess of ten thousand (10,000) pounds, or any auxiliary equipment attached to such a vehicle, for a period longer than 3 minutes in any hour while the vehicle is stationary, for reasons other than traffic congestion, on a public right-of-way or public space within 150 feet (46 meters) of a residential area, between the hours of 8:00 P.M. and 8:00 A.M. the following day.

ARTICLE IX RAILROAD OPERATIONAL NOISE LIMITS

9.1 No person shall operate, or permit to be operated, any railroad locomotive, cars, any other rolling stock or equipment, so as to cause a violation of the allowable sound levels adopted by the U.S. Environmental Protection Agency.

ARTICLE X ENFORCEMENT

10.1 Penalties

(a) Any person who violates any provision of this ordinance shall be fined for each offense not more than 100.00 dollars.

(b) Any person who willfully or knowingly violates any provision of this ordinance shall be fined for each offense a sum of not less than $100.00 and not more than $1,000.00 dollars.

(c) Each day of violation of any provision of this ordinance shall constitute a separate offense.

10.2 Abatement Orders

(a) In lieu of or in addition to issuing a notice of violation as provided in Section 10.3, the Noise Control Office responsible for enforcement of any provision of this ordinance may issue an order requiring abatement within a specified time period, of any source of sound alleged to be in violation of this ordinance and according to guidelines which the Noise Control Office may prescribe.

10.3 Notice of Violations

Violation of any provision of this ordinance shall be cause for a notice of violation to be issued by the Noise Control Office according to procedures set forth in ______________________.
(check with Mr. Busch)

10.4 Other Remedies

No provision of this ordinance shall be construed to impair any common law or statutory cause of action, or legal remedy therefrom, of any person for injury or damage arising from any violation of this ordinance or from other law.

10.5 Severability

If any provision of this ordinance is held to be unconstitutional or otherwise invalid by any court of competent jurisdiction, the remaining provisions of the ordinance shall not be invalidated.

10.6 Effective Date

This law/ordinance shall take effect on ______________________.